

**FIFTH FIVE-YEAR REVIEW REPORT  
FOR  
SAND SPRINGS PETROCHEMICAL COMPLEX SUPERFUND SITE  
TULSA COUNTY, OKLAHOMA**



March 26, 2020



**Prepared by  
U.S. Environmental Protection Agency  
Region 6  
Dallas, Texas**

**FIFTH FIVE-YEAR REVIEW REPORT  
SAND SPRINGS PETROCHEMICAL COMPLEX SUPERFUND SITE  
EPA ID#: OKD980748446  
TULSA COUNTY, OKLAHOMA**

This memorandum documents the U.S. Environmental Protection Agency's performance, determinations, and approval of the Sand Springs Petrochemical Complex Superfund Site Fifth Five Year Review under Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S. Code Section 9621(c), as provided in the attached Fifth Five-Year Review Report.

**Summary of the Fifth Five-Year Review Report**

The Fifth Five-Year Review for the Sand Springs Petrochemical Complex Superfund Site indicates that the remedial actions set forth in the decision documents for the site continue to be implemented as planned. The selected remedy for the Source Control Operable Unit (OU 01) was off-site thermal destruction coupled with on-site solidification/stabilization of site sludges and contaminated soils. The selected remedy for site groundwater, the Main Site Operable Unit (OU 02), was No Action, but with monitoring, following the Source Control Remedial Action.

Arcadis, Inc. (Arcadis), on behalf of BP/Atlantic Richfield Company (BP/ARCO), routinely maintains the site by performing landfill and site inspections, site maintenance, landfill leachate collection system operation and maintenance, and landfill groundwater monitoring-well maintenance. Arcadis also performs annual groundwater sampling at the site. Based on the Fifth Five-Year Review site inspection, data review, interviews, and technical assessment, the remedies for the Sand Springs Petrochemical Complex Superfund Site are protective of human health and the environment, because the selected remedies are a comprehensive approach for this site that address all current and potential future risks caused by wastes left in place.

**Environmental Indicators**

Human Exposure Status: Human Exposure Under Control

Contaminated Groundwater Status: Groundwater Migration Under Control

Site-Wide Ready for Reuse: The site achieved Site-Wide Ready for Anticipated Use status in 2011.

**Actions Needed**

The following actions must be taken for the remedy to be protective in the long term: None

**Determination**

I have determined that the remedy for the Sand Springs Petrochemical Complex Superfund Site is protective of human health and the environment. This Five-Year Review Report specifies that no actions need to be taken for the remedy to remain protective in the long term.

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Wren Stenger  
Director, Superfund and Emergency Management Division  
U.S. Environmental Protection Agency Region 6

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Date

## CONCURRENCES

**FIFTH FIVE-YEAR REVIEW REPORT  
SAND SPRINGS PETROCHEMICAL COMPLEX SUPERFUND SITE  
EPA ID#: OKD980748446  
TULSA COUNTY, OKLAHOMA**

**MICHAEL  
HEBERT**

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Michael Hebert, U.S. EPA  
Remedial Project Manager

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John C. Meyer  
Chief, Superfund Remedial Branch

\_\_\_\_\_  
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(see attached email concurrence)  
Amy Salinas  
Attorney, Office of Regional Counsel

3 – 18 – 20  
\_\_\_\_\_  
Date

(see attached email concurrence)  
Pam Travis  
Acting Chief, Superfund Branch, Office of Regional Counsel

3 – 25 - 20  
\_\_\_\_\_  
Date

**From:** [Salinas, Amy](#)  
**To:** [Hebert, Michael](#)  
**Subject:** RE: 0658 - Sand Springs Petrochemical Complex - Five Year Review Report for concurrence  
**Date:** Wednesday, March 18, 2020 10:54:33 AM

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I concur in the Five Year Review for the Sand Springs Petrochemical Complex Superfund Site.

Thanks,  
Amy

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**From:** Hebert, Michael <hebert.michael@epa.gov>  
**Sent:** Wednesday, March 18, 2020 10:44 AM  
**To:** Salinas, Amy <salinas.amy@epa.gov>  
**Subject:** 0658 - Sand Springs Petrochemical Complex - Five Year Review Report for concurrence

E-Version of Draft Sand Springs Petrochemical Complex Five Year Review Report

Sent for remote concurrence due to COVID-19 optional situational flexiplace.

Thanks, Hebert



**From:** [Travis, Pamela](#)  
**To:** [Hebert, Michael](#)  
**Subject:** RE: 0658 - Sand Springs Petrochemical Complex Five Year Review Report - for concurrence  
**Date:** Wednesday, March 25, 2020 2:15:06 PM

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Please accept this e-mail as my concurrence on the Sand Springs Petrochemical Complex Five Year Review Report.

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**From:** Hebert, Michael <hebert.michael@epa.gov>  
**Sent:** Wednesday, March 25, 2020 2:09 PM  
**To:** Travis, Pamela <Travis.Pamela@epa.gov>  
**Subject:** 0658 - Sand Springs Petrochemical Complex Five Year Review Report - for concurrence

E-Version of Draft Sand Springs Petrochemical Complex Five Year Review Report

Sent for remote concurrence due to COVID-19 situational flexiplace.

Thanks, Hebert

**ISSUES/RECOMMENDATIONS**  
**FIFTH FIVE-YEAR REVIEW REPORT**  
**SAND SPRINGS PETROCHEMICAL COMPLEX SUPERFUND SITE**  
**EPA ID#: OKD980748446**  
**TULSA COUNTY, OKLAHOMA**

**Issues/Recommendations**

**OU(s) without Issues/Recommendations Identified in the Five-Year Review:**

*Source Control Operable Unit, OU 01*  
*Main Site Operable Unit, OU 02*

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## LIST OF ABBREVIATIONS & ACRONYMS

ALR	Action Leakage Rate
ARARs	Applicable or Relevant and Appropriate Requirements
ARCO	Atlantic Richfield Company
BP	BP plc
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Corps	United States Army Corps of Engineers
DEQ	Oklahoma Department of Environmental Quality
DO	Dissolved Oxygen
DoD	Department of Defense
EPA	Environmental Protection Agency
FS	Feasibility Study
GPAD	Gallons Per Acres Per Day
kg	kilogram
L	liter
LNAPL	Light Non-Aqueous Phase Liquid
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
mg	milligram
MW	Monitoring Well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
OU 01	Source Control Operable Unit
OU 02	Main Site Operable Unit
POTW	Publicly Owned Treatment Works
PRP	Potentially Responsible Party
RA	Remedial Action
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SSPC	Sand Springs Petrochemical Complex
SARA	Superfund Amendments and Reauthorization Act
SOP	Standard Operating Procedure
SS	Solidification/Stabilization
SVOC	Semi-volatile organic compound
TBP	Tank Bottom Pit
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TTU	Transportable Treatment Unit
µg/L	Micrograms per Liter
USACE	U.S. Army Corps of Engineers
UU/UE	Unlimited Use/Unrestricted Exposure
VOC	Volatile Organic Compound

## I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review Reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this Five-Year Review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the Fifth FYR for the Sand Springs Petrochemical Complex (SSPC) Superfund Site. The triggering action for this statutory review is the completion of the Fourth FYR in 2015. The FYR has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The site consists of two Operable Units (OUs), and each OU will be addressed in this FYR. The Source Control OU (OU 01) addresses surface liquids, sludges, and heavily contaminated soils. The Main Site OU (OU 02) includes groundwater and minimally contaminated soils.

The SSPC Superfund Site FYR was led by the Oklahoma Department of Environmental Quality (DEQ). Participants included representatives of DEQ, Arcadis Inc. (Arcadis), BP/ARCO, and the EPA. The review began on 7/3/2019.

### **Site Background**

#### **Physical Location:**

The SSPC Site is located within the city limits of Sand Springs, Oklahoma, in Tulsa County, and comprises approximately 235 acres situated in an industrial complex on the northern bank of the Arkansas River (Figure 1). The complete site is bordered on the north by 21st Street and Morrow Road, and on the west by a spur to the Sand Springs Railway tracks (approximately 250 feet west of South Lincoln Avenue). The remainder of the site, to the south and southeast, is bordered by the Arkansas River.

It is noted that while the original investigated site comprised approximately 235 acres, a large percentage of the original acreage is not closely monitored, as those portions have been fully investigated and/or remediated. The pertinent portions of the historic site, still monitored, are centered around the landfill, the monitoring well network associated with the landfill, businesses in close proximity to the landfill, and the open lands south of both the landfill and levee.

The site is divided north/south by an 18 to 20-foot high levee situated between the Resource Conservation and Recovery Act (RCRA) Title C landfill and the Arkansas River. The southern portions of the site, south of the levee, slope to the Arkansas River and are a mix of Bermuda grass and small wooded stands. Approximately 400 feet of the Arkansas River has had rip rap and/or drainage ways added for site stabilization. The landfill, north of the levee, encompasses approximately 8 acres and is vegetated with native grasses. Two passive vent caps are situated at the crest of the landfill, and there are eight collection/detection sumps situated around the perimeter of the landfill (Figure 2). The landfill is fenced by a 6-foot chain-link fence, with two access gates and has a perimeter gravel base access road surrounding it.

The remaining site acreage, north of the landfill, is comprised of numerous businesses currently occupying the site. As previously stated, most of these businesses occupy land that originally was incorporated within historic investigations, but which are now not closely monitored. The site as a whole is relatively open, with the exception

of two high-voltage transmission towers, located southeast and southwest of the landfill, just north of the levee. Active transmission lines cross the site across these towers. There are existing transmission lines on wooden poles at various locations throughout the site. There are also two sanitary sewer mains along the levee at the south edge of the site boundary.

#### Hydrology:

The SSPC is adjacent to the Arkansas River, on an alluvial flood plain. Subsurface investigations conducted in the vicinity of the landfill showed the fill material to be at an approximate depth of 10 feet. The thickness of the alluvial materials beneath the fill, based on boring logs from the site, ranges from 25.0 feet to 41.2 feet. In general, the alluvium thickness averages 35-40 feet, near the river, and decreases to the north. The alluvial materials primarily consist of silt and fine- to medium-grained sand. Terrace deposits, primarily thick alluvial deposits of fine- to medium-grained sand, exist just north and upgradient of the site. The uppermost bedrock underlying the site is the Coffeyville Formation, which is composed of shales, thin bedded sandstones, and siltstones. The portion of the Coffeyville Formation underlying the site is estimated to be approximately 280 feet thick.

The alluvial groundwater is recharged by infiltration of rainfall and surface water through the Newblock Park terrace and Arkansas River alluvium. This recharge is expected to add to the amount of groundwater flow beneath the site, which under typical groundwater flow conditions discharges into the Arkansas River.

In situ aquifer tests performed at the site indicate the alluvial aquifer has a high hydraulic conductivity. Groundwater moves at a rapid rate (several hundred feet per year) and discharges to the Arkansas River during most of the year (stable or falling river stages). During periods of high river levels, a gradient reversal may occur, causing river water to recharge the alluvial aquifer. However, gradient reversals have not been documented through field measurements.

Hydraulic conductivity data for the Coffeyville Formation is not available, but field observations of rock cores and borehole tests indicated hydraulic conductivities to be several orders of magnitude lower than for the overlying alluvial deposits. This difference in hydraulic conductivity indicates that movement of groundwater will primarily be lateral, within the alluvium. The extremely low hydraulic conductivity of the underlying shale will impede the infiltration of groundwater from alluvium to bedrock.

A water well survey conducted in the early 1980s determined that the nearest residential drinking water wells are approximately one mile east of the site; these wells are upgradient of the site. The community of Sand Springs obtains its municipal water supply from surface sources.

#### Land and Resource Use:

Historical land use is unknown, prior to the establishment of refinery operations in the early 1900s. Initially, Pierce Petroleum Refinery occupied the site. The refinery was subsequently acquired by the Sinclair Oil Corporation in the early 1930s and continued to operate until 1948 when most of the refinery operations were shut down. The site has been used for a number of industrial activities that have contaminated large areas of the surface and subsurface. Events in the site's history include the creation of sludge pits, unlined lagoons used for solvent recycling, and accidental spillages of petroleum hydrocarbons from storage tanks. By October of 1953, Sinclair had conveyed all but approximately 38 acres of the refinery property to the Sand Springs Home. Since 1953, a variety of industries leased or purchased property from Sand Springs Home. In 1969, Sinclair merged with Atlantic Richfield Company (ARCO) and the 38-acre tract of land was absorbed in the merger. The 38-acre tract became the site of a Chemlink Chemical plant that was subsequently sold (D&B, 2004). The Baker Chemical Company currently owns and/or leases the 38-acre tract.

Several solvent and oil recycling facilities operated on a 5.5-acre portion of the SSPC from 1964 through 1983. This 5.5-acre area is referred to as the Glen Wynn area. Two unlined pits, numerous tanks and drums, and contaminated soils from accidental spills remained on the Glen Wynn site from the previous recycling operations. In December 1980, the Environmental Protection Agency (EPA) and state agencies became concerned about the possible contamination at the site. Over the next 3 years, water and soil samples were collected and analyzed to

determine any potential risks to human health or the environment. Results of the tests indicated that contact with the sludge and contaminated soils posed a human health risk, and CERCLA, commonly known as Superfund, would be used to address contamination at the site. Though the Glen Wynn site was the original focus of investigations, additional investigations resulted in the entirety of the site to include 235 acres.

### **FIVE-YEAR REVIEW SUMMARY FORM**

SITE IDENTIFICATION		
<b>Site Name:</b> Sand Springs Petrochemical Complex		
<b>EPA ID:</b> OKD980748446		
<b>Region:</b> 6	<b>State:</b> OK	<b>City/County:</b> Sand Springs / Tulsa County
SITE STATUS		
<b>NPL Status:</b> Deleted		
<b>Multiple OUs?</b> Yes	<b>Has the site achieved construction completion?</b> Yes	
REVIEW STATUS		
<b>Lead agency:</b> EPA		
<b>Author name (Federal or State Project Manager):</b> Kelsey Bufford		
<b>Author affiliation:</b> Oklahoma Department of Environmental Quality		
<b>Review period:</b> 7/3/2019 - 7/3/2020		
<b>Date of site inspection:</b> 10/15/2019		
<b>Type of review:</b> Statutory		
<b>Review number:</b> 5		
<b>Triggering action date:</b> 7/3/2015		
<b>Due date (five years after triggering action date):</b> 7/3/2020		



## II. RESPONSE ACTION SUMMARY

### **Basis for Taking Action**

According to the Source Control OU Record of Decision (ROD), the organic chemicals of concern detected in soil samples during the Remedial Investigation (RI) were benzene, trichloroethylene, 1,1,1-trichloroethane, and 1,2-dichloroethane. The inorganic chemicals of concern detected in soil samples were barium, chromium, arsenic, lead, cadmium, mercury, and silver. Benzene, trichloroethylene, 1,1-dichloroethylene, 1,1,1-trichloroethane, 1,2-dichloroethane, and vinyl chloride were the detected organic chemicals of concern above Maximum Contaminant Level (MCLs) in groundwater samples. The inorganic compounds of concern detected above MCLs in groundwater were barium, chromium, arsenic, lead, cadmium, and mercury.

Based on the data collected during the RI, it was determined that if the remedies selected in the Source Control OU ROD were not implemented, hazardous substances could be released from the site and endanger public health, welfare, or the environment. The most significant risks to human health and the environment included the following:

- 1) Direct Contact – many of the organic compounds found on the site have been determined to be carcinogens. Absorption through the skin or other routes of inadvertent ingestion therefore poses potential health risks. In addition, the wastes and surface waters were found to be highly acidic (EPA 1987).
- 2) Air Emissions – consisting of acid fumes and volatile organic compounds (VOCs) also pose potential health threats.
- 3) Surface Waters – pollution caused by the runoff from the site.
- 4) Groundwater – contamination directly by the Glen Wynn lagoons and indirectly by runoff from the main site.

### **Response Actions**

An EPA Region 6 groundwater investigation was conducted in December 1980. In September 1983, EPA proposed the SSPC to the National Priorities List (NPL). EPA ordered potentially responsible parties (PRPs) to conduct emergency removal of drums and tanks in August 1984, and in June 1986 the SSPC was promulgated for inclusion on the NPL.

#### **Source Control Operable Unit, OU 01**

The Source Control OU included all surface liquids, sludges, and heavily contaminated soils. In September 1987, EPA issued the ROD for the Source Control OU of the SSPC. The remedial action remedy chosen for the Source Control OU is as follows:

- 1) The excavation and off-site thermal destruction of sludges, at least to the sludge/soil interface, from the portion of the site identified as the North and South Glen Wynn Lagoons.
- 2) Solidification and/or stabilization of all remaining sludges and containment of the resulting matrix in a hazardous waste RCRA cell to be constructed on-site. This cell (or cells) is to meet the minimum technological requirements of Subtitle C of the Solid Waste Disposal Act.
- 3) As part of the remedial design, Atlantic Richfield Petroleum Products Company, a division of ARCO, will demonstrate that the solidification technology will meet EPA approved criteria. These criteria will include both chemical and physical testing requirements. Should the solidification technology fail these criteria, thermal destruction will be the remedy for the above-mentioned operable unit.
- 4) No liability release from the site or from future maintenance and monitoring.
- 5) Repair or restoration of the RCRA cell to ensure no migration from the unit or destruction or treatment of all or a portion of its contents, as EPA deems appropriate, should monitoring show that the solidification and/or stabilization remedy fails.

The cleanup criteria for OU 01 was a general visual determination which would remove sludges down to the sludge/soil interface and an additional foot below this interface or to a specific depth. After removal down to this interface, sampling would be performed to determine if benzo(a)pyrene was less than 100 mg/kg.

Remedial action objectives included in the OU 01 ROD included:

- Solidification/Stabilization of all sludges in the Source Control Operable Unit
- Off-site thermal destruction of the Glen Wynn sludges

#### Main Site Operable Unit, OU 02

The Main Site OU included groundwater and minimally contaminated soils. In June 1988, EPA issued the ROD for Main Site OU. The Main Site OU ROD stated that in EPA's judgment, Alternative 1, No Action (Monitoring following the Source Control Remedial Action) met the statutory selection criteria. Factors supporting this decision included: after the Source Control Remedial Action, a natural flushing action will have decreased the level of contamination over time; the groundwater and the Arkansas River are not sources of drinking water; and there are no public health threats from the minimally contaminated soil. The State of Oklahoma concurred with this remedy.

The remedial action remedy chosen for the Main Site OU is as follows:

- 1) Place appropriate warning signs.
- 2) Restrict access.
- 3) Collect and analyze groundwater for a period of at least 30 years.

There were no specific cleanup criteria for the groundwater in OU 02, since there was no remedial action.

Remedial action objectives included in the OU 02 ROD included:

- Monitor groundwater in order to determine impacts of Source Control (OU 01) remedy

EPA determined that the alternatives chosen for both OUs are protective of human health and the environment, attain federal and state requirements that are applicable or relevant and appropriate, are cost-effective compared to equally environmentally protective alternatives, and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

### **Status of Implementation**

ARCO, one of the potentially responsible parties for the site, managed the full remediation activities for the SSPC. The Tulsa District United States Army Corp of Engineers (USACE) provided oversight for EPA during the Additional Site Characterization, Remedial Design (RD), and Remedial Action (RA), and continued in this function during the beginning years of the Operation and Maintenance (O&M) phase. Remedial activities have been completed in phases.

#### Source Control Operable Unit, OU 01

##### *Glen Wynn Site*

Remedial activities for the Glen Wynn portion of the SSPC commenced in August 1992. The remediation included the following six areas within the site: North Lagoon, South Lagoon, Drum Area, T-5 Area, L-Shaped Area, and Pump House.

Except for the Pump House, remediation of the sites consisted of excavating contaminated material and transporting this material to off-site hazardous waste incinerators. After excavation areas were completed, the excavations were backfilled and compacted with either stockpiled soil from the site or with clean fill from off-site sources. Contaminated debris, generated during the remediation, was transported to the Lone Mountain Hazardous Waste facility, located in Major County, Oklahoma.

The Pump House contained drums of drill cuttings, drums of monitor well purge water, and plastic bags of personal protective equipment. This material was generated from previous investigations at the SSPC. All solid material was tested and either incinerated with other site wastes, stockpiled for later treatment, or transported to the Lone Mountain Hazardous Waste Facility. All water was treated on-site at the temporary wastewater treatment plant. Final site grading and seeding occurred in December 1992.

#### *Wastewater Treatment*

Construction was initiated on February 14, 1992, on a wastewater treatment plant on the site to treat water pumped from the retention pond and to treat storm water runoff that contacted the sludge pits. The retention pond was located between the large acid sludge pit and the small acid sludge pit. The wastewater treatment plant was dismantled prior to the completion of the remedial action in August 1995.

#### *Refinery Wastes*

During the RI and subsequent additional site characterization activities, six petroleum waste pits were identified that required excavation, treatment, and placement into the on-site landfill. The six pits were: Large Acid Pit, Small Acid Pit, Round River Pit, Levee Pit, Tank Bottom Pit (TBP), and Con-Rad Sludge Area. Excavated areas included the contaminated soils adjacent to these pits and the Surface Impoundment, located between the Large and Small Acid Pits.

Treatment consisted of mixing neutralized waste with stabilizing additives in a transportable treatment unit (TTU). This produced a stabilized material that was then placed within the on-site RCRA Subtitle C landfill. The RCRA landfill was constructed of eight separate cells. Each cell contained a separate pipe system for leachate collection and leachate detection. A perimeter drain surrounds the landfill and two gas vents were installed at the top of the landfill cap. A security fence was placed around the perimeter of the landfill.

Approximately 206,500 cubic yards of solidified sludge and soil were excavated, treated in the TTU, and placed in the landfill. The remedial activities were completed on August 22, 1995.

#### Main Site Operable Unit, OU 02

Remediation activities for OU 02 consisted of installing seven new monitoring wells (MW-101 to MW-107) and using two existing wells (MW-14 and MW-15) installed during the RI. The seven new wells are located around the landfill and consist of three upgradient wells (MW-101 through MW-103) and four downgradient wells (MW-104 through MW-107). The two existing wells, MW-14 and MW-15, are located upgradient of the landfill (MW-14 was permanently abandoned in August 2017 and replaced with MW-14R in September 2018). Two of the new wells (MW-106 and MW-107) were installed on the levee and were used for downgradient pre-closure monitoring.

Monitoring of the groundwater was divided into pre-closure and post-closure monitoring. Pre-closure monitoring consisted of collecting samples on a quarterly basis for a period of one year from MW-14, MW-15, MW-106, and MW-107. After closure of the landfill, a baseline monitoring period was initiated. Seven monitoring wells (MW-101 through MW-107), were sampled quarterly during the first year after the landfill closure. At the end of the one-year baseline period, the remainder of the 30-year post-closure monitoring was initiated. Post-closure monitoring was established as one year of semiannual sampling, then eight years of annual sampling, followed by sampling on a 5-year cycle. MW-119 was installed in 2007 to act as a downgradient well to the former Glen Wynn site and has been added to the monitoring well network that is currently sampled on a yearly basis.

The site was deleted from the NPL in 2000.

#### Additional Removal Activities: Arkansas River Sludge Removal

During routine O&M activities for the SSPC in May 2001, seeps of black sludge were observed near the former acid sludge disposal pit along the northern bank of the Arkansas River. In 2002 and 2003, site assessments were performed, and a work plan was submitted in 2004 for excavating the sludge materials eventually discovered from

six areas. Removal activities of approximately 30,689 cubic yards of materials were performed between October 2004 and January 2006. This material was subsequently excavated and transported to the WMI Quarry Landfill. The disturbed area was re-vegetated and rip rap was placed to protect the area from erosion. A Riverbank Sludge Removal Report was submitted in April 2006, documenting these activities.

### **IC Summary Table**

**Table 1:** Summary of Planned and/or Implemented ICs

<b>Media, engineered controls, and areas that do not support UU/UE based on current conditions</b>	<b>ICs Needed</b>	<b>ICs Called for in the Decision Documents</b>	<b>Impacted Parcel(s)</b>	<b>IC Objective</b>	<b>Title of IC Instrument Implemented and Date (or planned)</b>
Groundwater and Soil	Yes	No	Glen Wynn portion of Site	Restrict residential use, residential daily care, PreK-12 schools, edible agricultural uses	May 7, 2014 Notice of Remediation
Arkansas River Alluvium Groundwater	Yes	No	W 1/2 of NW 1/4 of Section 13, T19N, R11EIM and NW 1/4 of Section 14, T19N, R11EIM	No water supply wells allowed between 0-37 feet due to metals and VOCs contamination, and special well construction is required	Oklahoma Administrative Code (OAC) Title 785, Chapter 45, Appendix H, Beneficial Use Designations for Certain Limited Areas of Groundwater

### **Systems Operations/Operation & Maintenance**

After the construction phase of the RA was completed, the maintenance of the monitor wells and the landfill was initiated in accordance with the Post-Closure Plan and the Landfill Groundwater Monitoring Plan. The property owner, Sand Springs Home, granted access to the property for maintenance oversight and inspection activities. Under this agreement, ARCO is conducting the O&M activities. An updated O&M Plan was prepared in February 2012. The O&M plan includes procedures for site and landfill inspections, site maintenance, landfill leachate collection system operation and maintenance, and landfill groundwater monitoring.

#### **Site and Landfill Inspections**

Site and landfill inspections include the following activities:

- 1) Inspect the landfill cap and side slopes for physical deformities, vegetative cover, slope stability, and any signs of subsidence;
- 2) Inspect the perimeter roads, perimeter security fence, and perimeter drain system;
- 3) Inspect the landfill vents, monitor wells, and leachate collection system;
- 4) Inspect other on-site areas, excluding the landfill, for signs of erosion, adequate surface drainage, and vegetative cover;
- 5) Maintain rip rap;
- 6) Sample the on-site monitor wells in accordance with the post-closure monitoring schedule; and,
- 7) Measure and remove leachate from the leachate collection and leachate detection system.

### Site and Landfill Maintenance

Site and landfill maintenance include the following:

- 1) Correction of any deficiencies noted during inspection of the above-mentioned items; and
- 2) Mowing, fertilizing and weed control.

### Leachate Collection System

The landfill structure was completed with eight cells, each of which is equipped with a leachate collection system consisting of two separate drainage structures designed to intercept and collect any potential leachate. The upper drainage structure is termed the collection system, and the lower drainage structure is termed the detection system. The collection systems are isolated by two impermeable high-density polyethylene liners. One liner is located between the collection system and detection system, and a second liner is located below the detection system. The system is operated on an as-need basis to remove leachate that accumulates in the leachate collection sumps.

In 2018, the existing pumps installed in the collection and detection cells were removed due to operational issues, and a new leachate collection system using a trailer and portable pump was incorporated. The portable pump was used to pump leachate from the sumps into a trailer-mounted holding tank. When the holding tank is full, the valves close and the pumps are shut down. Each tank load of leachate is considered a batch, and each batch is tested for pH in accordance with the permit requirements for the City of Sand Springs pre-industrial treatment program. If testing of the batch exceeds pH 9, the pH is adjusted to between six and nine, prior to release to the Sand Springs Publicly Owned Treatment Works (POTW).

### Monitor Well Sampling

Monitor wells are currently being sampled on an annual basis as specified by the Landfill Groundwater Monitoring Plan. The wells are sampled for the list of constituents shown in Appendix B. Figure 3 shows the monitoring well network. The groundwater monitoring wells are sampled using dedicated low flow pumps. On August 14, 2017, monitoring well MW-14 was permanently abandoned by Able Environmental Drilling, LLC, under the supervision of Arcadis. The monitoring well was abandoned, due to site redevelopment plans to occur at the Valued Partners Investment LLC (formerly Morrow Gill Lumber Inc.) property, which would have destroyed the monitoring well. In September 2018, MW-14R was installed offsite to replace MW-14.

### Survey

The landfill is to be periodically surveyed at least once every five years, according to the O&M Plan. A survey of the landfill was conducted in 2007 and 2008 to establish a baseline of landfill elevations. Subsequent surveys will be conducted and compared to the baseline to determine if there is subsidence. A five-year landfill survey was completed in November 2018, with a licensed State of Oklahoma surveyor, to determine if subsidence has occurred. Based on the comparison with previous surveys, no subsidence has occurred (Appendix C).

### Annual Inspection Reports

Arcadis, on behalf of BP/ARCO, submits inspection reports on an annual basis to EPA Region 6 and DEQ. The reports consolidate the quarterly inspection reports, annual groundwater sampling laboratory reports, and leachate collection logs.

Noted major observations and required action items, as they apply to basic O&M activities, from the O&M quarterly inspection reports are as follows below for the years 2015 to 2018. Semi-regular occurrences such as the need to repair gravel roads or eradicate noxious vines are not listed. Accompanying each observation/action item is any follow-up action taken and/or current status of that issue or observation.

#### 2015 Annual Inspection Report

- There were no known operational problems or required action items noted in the 2015 Annual Report.

#### 2016 Annual Inspection Report

- There were no known operational problems or required action items noted in the 2016 Annual Report.

#### 2017 Annual Inspection Report

- Monitoring well MW-14 was permanently abandoned on August 14, 2017.

#### 2018 Annual Inspection Report

- Monitoring well MW-14 was replaced with monitoring well MW-14R, in September 2018.
- Leachate pumps, which were no longer operating properly, were removed and a new mobile leachate recovery system was incorporated.

### III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the **2015 FYR**, as well as the recommendations from the **2015 FYR** and the current status of those recommendations.

**Table 2:** Protectiveness Determinations/Statements from the **2015 FYR**

<b>OU #</b>	<b>Protectiveness Determination</b>	<b>Protectiveness Statement</b>
1	Protective	The remedy implemented at the Sand Springs Petrochemical Complex Site to date is protective of human health and the environment.
2	Protective	The remedy implemented at the Sand Springs Petrochemical Complex Site to date is protective of human health and the environment.
Sitewide	Protective	The remedy implemented at the Sand Springs Petrochemical Complex Site to date is protective of human health and the environment.

**Table 3: Status of Recommendations from the 2015 FYR**

<b>OU #</b>	<b>Issue</b>	<b>Recommendations</b>	<b>Current Status</b>	<b>Current Implementation Status Description</b>	<b>Completion Date (if applicable)</b>
1	Site documents could not be located at the site repository.	Submit site documents to the new location of the Charles Page Library at 551 E Fourth Street, Sand Springs, Oklahoma 74063.	Completed	The PRP's placed documents in the site repository. Kelsey Bufford (DEQ) and Amy Brittain (DEQ) inspected the site repository on October 15, 2019, and confirmed the Superfund Site documents have been relocated to the Charles Page Library.	4/19/2016
2	Arsenic levels in MW-104 and MW-105 have shown exceedances of the arsenic MCL since the last five-year review.	Continue to monitor arsenic levels closely.	Completed	The analytical groundwater sampling results from the 2015 – 2018 annual reports show that arsenic continues to be present in MW-104 and MW-105 at concentrations greater than the MCL for drinking water (10 µg/L). The sampling results also show that arsenic concentrations have increased over the last five years.	3/15/2017
1	According to the groundwater monitoring plan, monitoring data will be evaluated for statistical analysis every four years. A statistical analysis has not been run since 2002.	Groundwater data should be evaluated statistically for trends, as stated in the groundwater monitoring plan, to demonstrate that the remedy is functioning as intended.	Completed	Statistical analysis was performed on the groundwater sampling results in 2015 and 2016. The next statistical analysis will be performed in 2020.	2/23/2016

## **IV. FIVE-YEAR REVIEW PROCESS**

### **Community Notification, Involvement & Site Interviews**

A public notice was made available by the local newspaper, the “Sand Springs Leader”, on 8/14/2019, stating that there was a Five-Year Review and inviting the public to submit any comments to the DEQ and U.S. EPA. The results of the review and the report will be made available at the site information repository, located at Charles Page Library, 551 East 4th Street, Sand Springs, OK, 74063. A second notice will be published in the Sand Springs Leader when the review is complete.

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that have been implemented to date. Interview questionnaires were distributed to representatives of DEQ, Arcadis, Sand Springs Home, and the City of Sand Springs. No other public inquiries into the FYR were made during the period of this review. The results of the interviews are summarized below.

The interviews suggest that the remedy is functioning as designed. According to interview responses from Arcadis managers, DEQ staff, and local city officials, the remedy is performing well and groundwater contaminant levels are predominantly showing declining trends. The landfill cap has been maintained as intended, leachate recovery activities have improved since implementation of the new leachate removal system, the solar sipper recovery system continues to operate and recover Light Non-Aqueous Phase Liquid (LNAPL) from MW-104, and annual groundwater sampling data indicate no groundwater impacts are migrating offsite.

Complete interviews are included in Appendix D.

### **Data Review**

#### **Leachate Collection Data**

The collection of leachate from the collection and detection cells is summarized in Appendix E. Appendix F shows the gallons per acre per day (GPAD) values for the years 2002 to 2018. An Action Leakage Rate limit of 560 GPAD was established in the Post Closure Plan for the detection cells. Based on the quantity of water pumped from the sumps, GPAD values for the total pumped from both the collection and detection sumps since the Fourth FYR were below the 560 GPAD limit.

#### **Groundwater Monitoring Data**

Groundwater monitoring is performed on an annual basis and reported in the annual inspection reports. The constituents being monitored in the groundwater are listed in Appendix B. A summary table of the sampling results from the Landfill Groundwater Monitoring Program for the 1995 through 2018 sampling events is included in Appendix G. A map showing the concentrations of the constituents per monitoring well from 2014 – 2018 is provided in Appendix H. Based on review of groundwater data since the Fourth FYR, groundwater concentration trends for most monitored constituents have predominantly remained stable or declined, except for arsenic. Arsenic continues to be present in MW-104 and MW-105 at concentrations greater than the MCL for drinking water (10 µg/L). The sampling results also show that arsenic concentrations have increased over the last five years. Appendix I summarizes the results of the Mann Kendall statistical trends from 1995 – 2016.

#### **LNAPL Data**

Historically, LNAPL has been identified in monitoring wells MW-104 and MW-105. A summary of LNAPL thickness detections in MW-104 and MW-105 is included in the annual inspection reports. According to the inspection reports, MW-105 did not contain any measurable LNAPL or a sheen, since the Fourth FYR. MW-104 had LNAPL thickness ranging from 0.09 – 2.83 feet. The amount the LNAPL recovered from MW-104 ranged from 13 – 110 gallons, since the Fourth FYR.



### **Site Inspection**

The inspection of the site was conducted on 10/15/2019. In attendance were Michael Hebert, EPA; Kelsey Bufford, DEQ; Amy Brittain, DEQ; Jason Luckett, Arcadis; Tyler Stewart, AFS; and John Frankenthal, BP. The purpose of the inspection was to assess the protectiveness of the remedy.

Overall, the site remedy continues to operate as intended. There were no issues observed during the inspection that might impact current or future protectiveness of the remedy. The landfill cover did not show any signs of structural damage, and vegetation was well established.

The Brenntag Southwest facility (Brenntag) shares a fence-line boundary with the SSPC site. During the site inspection, it was noted that a large number of containers staged by Brenntag were piled along the fence line that could potentially compromise the integrity of the fence. Per the request of BP and the EPA, the DEQ Superfund Program requested the DEQ RCRA Program to perform a Focused Compliance Inspection (FCI) to determine if Brenntag was improperly handling the containers. The RCRA Program performed a site inspection at Brenntag on November 7, 2019. No violations were observed. The empty drums had been removed from the fence line and shipped off-site for re-conditioning. Receipts show that the drums were picked up from Brenntag October 15 – 22, 2019, shortly after the SSPC site inspection and prior to the FCI.

There have been no complaints from the public about the site; however, in June 2018, the site was broken into by cutting the front gate lock with bolt cutters. There was no vandalism or theft from the site; however, access from the site was used to cut into a fence leading to the neighboring property, Tulsa Combustion, where hand tools were stolen. A police report was filed, and all damaged site locks and fences were repaired.

The results of the inspection are recorded in the Site Inspection Checklist (Appendix J). Appendix K provides site photos from the inspection.

## V. TECHNICAL ASSESSMENT

**QUESTION A:** Is the remedy functioning as intended by the decision documents? Yes

The remedy continues to function as intended in Source Control OU 01 (1987 ROD) and Main Site (groundwater) OU 02 (1988 ROD) based on the site inspection and technical review. There were no observed issues at the site.

### Landfill Condition

The landfill is operating as intended by the ROD. The landfill continues to be properly maintained via quarterly inspections for any signs of structural disturbance and is sufficiently working as a barrier to inhibit exposure, minimize migration of contaminants to groundwater, and prevent contact with or ingestion of contaminants within the landfill boundaries.

### Institutional Controls

The industrial zoning designations, provided by the City of Sand Springs, serve as institutional controls to restrict site access. There were no changes in the land use activities or physical conditions since the Fourth FYR that would affect the protectiveness of the remedy. The institutional controls are functioning as intended in preventing exposure to contaminants.

### Leachate Collection System

Leachate collection has improved since implementation of the new leachate removal system in 2018. The leachate system upgrades have optimized O&M efforts by reducing maintenance needs and improving leachate removal efficiency.

### Groundwater Monitoring:

Groundwater monitoring is a protectiveness remedy component ensuring that the landfill is functioning as designed. Based on review of groundwater data since the Fourth FYR, groundwater concentration trends have predominantly remained stable or declined.

The analytical groundwater sampling results from the 2015 – 2018 annual reports show that arsenic continues to be consistently present in MW-104 and MW-105 at concentrations greater than the MCL for drinking water (10 µg/L). The sampling results also show that arsenic concentrations have increased over the last five years. The Main Site OU ROD states that the rationale for selecting the “No Action” remedy is based on finding of the RI/FS which concluded that groundwater and the Arkansas River are not sources of drinking water in the area. The arsenic concentrations in the wells are also less than the concentrations specified in the ROD as being protective of human health and the environment (1,400 µg/L).

The presence of arsenic in the groundwater may be the result of reductive dechlorination of the chlorinated compound groundwater contamination which could change the chemical bonds of naturally occurring arsenic in the soil, thus increasing the potential release of arsenic from the soil to groundwater. The detection of arsenic should not alter the protectiveness provided by the ROD; however, monitoring should continue and the trends in arsenic concentrations should be evaluated.

### Light Non-Aqueous Phase Liquids

Historically, LNAPL has been identified in monitoring wells MW-104 and MW-105. According to the inspection reports, MW-105 did not contain any measurable LNAPL or a sheen, since the Fourth FYR.

The source of hydrocarbons impacting MW-104 and MW-105 is unknown and has been present since construction of the landfill. The hydrocarbons are not associated with the treated material contained within the Subtitle C Landfill cells and do not reflect negatively on the landfill integrity.

**QUESTION B:** Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid? Yes

No new laws or regulations have been promulgated or enacted that would call into question the effectiveness of the remedy to protect human health and the environment.

**QUESTION C:** Has any **other** information come to light that could call into question the protectiveness of the remedy? No

No other information has been identified that could impact protectiveness of the remedy.

## VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
<b>OU(s) without Issues/Recommendations Identified in the Five-Year Review:</b>
<i>Source Control Operable Unit, OU 01</i> <i>Main Site Operable Unit, OU 02</i>

## OTHER FINDINGS

- Arsenic continues to be present in MW-104 and MW-105 at concentrations greater than the MCL for drinking water (10 µg/L). The sampling results also show that arsenic concentrations have increased over the last five years. However, these results are not affecting a drinking water source or the Arkansas River and therefore, do not affect protectiveness of human health or the environment. Monitoring of arsenic levels and evaluation of trends in arsenic levels will continue.

## VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
<i>Operable Unit:</i> Source Control Operable Unit, OU 01	<i>Protectiveness Determination:</i> Protective
<i>Protectiveness Statement:</i> The remedy implemented at the Sand Springs Petrochemical Complex Superfund Site Operable Unit 1 is protective of human health and the environment.	

Protectiveness Statement(s)	
<i>Operable Unit:</i> Main Site Operable Unit, OU 02	<i>Protectiveness Determination:</i> Protective
<i>Protectiveness Statement:</i> The remedy implemented at the Sand Springs Petrochemical Complex Superfund Site Operable Unit 2 is protective of human health and the environment.	

Sitewide Protectiveness Statement	
<i>Protectiveness Determination:</i> Protective	
<i>Protectiveness Statement:</i> The remedy implemented at the Sand Springs Petrochemical Complex Superfund Site is protective of human health and the environment.	

## VIII. NEXT REVIEW

The next five-year review report for the Sand Springs Petrochemical Superfund Site is required five years from the completion date of this review.

## REFERENCE LIST

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Parsons, 2012. Operation, Maintenance, and Monitoring Plan for the Sand Springs Petrochemical Complex Site, Tulsa County, Sand Springs, Oklahoma. February 2012.

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U.S. Environmental Protection Agency (EPA), 1987. EPA Superfund Record of Decision: Sand Springs Petrochemical Complex, Oklahoma (Source Control OU), EPA ID: OKD980748446, OU 01, Sand Springs, Oklahoma. EPA/ROD/R06-87/024. September 29, 1987.

U.S. Environmental Protection Agency (EPA), 1988. Main Site Operable Unit Remedial Investigation Report, Sand Springs Petrochemical Site, Tulsa County, Oklahoma. June 1988.

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U.S. Environmental Protection Agency (EPA), 1997. EPA Final Close Out Report: Sand Springs Petrochemical Site, Sand Springs, Oklahoma. September 30, 1997.

U.S. Environmental Protection Agency (EPA), 2015. Fourth Five-Year Review Report for Sand Springs Petrochemical Complex Superfund Site, Tulsa County, Oklahoma. July, 2015.

# APPENDIX A

## Site Chronology

#### Appendix A: Site Chronology

Event	Date
Pierce Petroleum begins to refine oil on the site	Early 1900s
Sinclair Oil purchases the Pierce Petroleum Refinery	1930
Sinclair Oil Refinery is shut down and dismantling begins	1948
Sinclair Oil conveys property to the Sand Springs Home, but retains 38 acres	1953
Sand Springs Home leases 5.5 acres of its property to Glenn Wynn	1964
Sinclair Oil merges with Atlantic Richfield Company (ARCO)	1969
EPA Region 6 investigates groundwater contamination at the site	December 1980
EPA proposes Sand Springs site for inclusion on the National Priorities List	September 1983
EPA orders potentially responsible parties to conduct emergency removal of drums and tanks	August 1984
EPA promulgates Sand Springs site for inclusion on the National Priorities List (NPL)	June 1986
Oklahoma State Department of Health in cooperative agreement with EPA completes the Remedial Investigation (RI) / Feasibility Study (FS) for the Source Control and Main Site (groundwater) Operable Units	May 1987
ARCO and citizens comment on the Source Control RI/FS; ARCO begins treatability studies pursuant to an Administrative Order of Consent with EPA	June 1987
EPA issues the Record of Decision (ROD) for the Source Control Operable Unit (OU 01)	September 1987
EPA issues the ROD for the Main Site Operable Unit (OU 02)	June 1988
Tank Bottom Pit sludge moved to the Small Acid Pit	September 1991
ARCO completes treatability studies	July 1992
Remedial Action (RA) on the Glenn Wynn portion of the site begins	August 1992
RA on the Glenn Wynn portion of the site is completed	November 1992
RA on the acid tar wastes begins, initiation of landfill construction	July 1993
Solidification/stabilization (SS) treatment of waste begins	April 1994
Excavation and neutralization of all waste at site completed	January 1995
Landfill cap installation initiated	April 1995
Treatment completed and landfill closed	August 22, 1995
RA Completion Ceremony held	August 29, 1995
Groundwater quarterly sampling, and operation and maintenance (O&M) activities initiated	October 1995
Final Close-Out Report	September 30, 1997



Deletion from NPL	March 17, 2000
First Five-Year Review	September 2000
Petroleum material was observed on the surface between the Arkansas River Levee and the Arkansas River	May 2001
Work plan developed and implemented to investigate the nature and extent of seeps of black sludge observed on the north bank of the Arkansas River	June 2002
Additional Site Characterization Report completed	July 2003
Atlantic Richfield and EPA sign an AOC to conduct an emergency removal action	October 2004
Initiation of Work Plan to remove observed petroleum tars, including excavation and removal of material	October 2004
Removal activities scheduled to be completed	October 2005
Second Five-Year Review	September 2005
Riverbank Sludge Removal Final report submitted	April 2006
Final Operations and Maintenance Plan submitted	July 2007
Public notice announcing commencement of the Third Five-Year Review published in the <i>Sand Springs Leader</i>	October 18, 2009
Site Inspection for the Third Five-Year Review of the Sand Springs Site conducted by EPA, DEQ, and USACE	October 21, 2009
Third Five-Year Review	April 2010
Soil was excavated and removed from the area south of the west drainage berm	July 2010
Petroleum tar extrusion removal	July 2010
Six no longer usable groundwater monitoring wells were removed and plugged	July 2010
Rip rap material was added to Arkansas River bank	September 2010
2010 Annual Report	December 2010
Additional rip rap material was added to Arkansas River bank	October 2011
2011 Annual Report	January 2011
Revised Operation, Maintenance, & Monitoring Plan submitted to DEQ	February 2012
2012 Annual Report	January 2013
Site Inspection for the Fourth Five-Year Review conducted by DEQ	October 23, 2014
2013 Annual Report	January 2014
2014 Annual Report	January 2015
Fourth Five-Year Review	July 2015
2015 Annual Report	February 2016
2016 Annual Report	April 2017
2017 Annual Report	March 2018
2018 Annual Report	May 2019
Site Inspection for the Fifth Five-Year Review conducted by DEQ	October 15, 2019

Fifth Five-Year Review  
Sand Springs Petrochemical Complex

## APPENDIX B

### Groundwater Monitoring List of Constituents

## Appendix B: Groundwater Monitoring List of Constituents

Metals	Volatile Organic Compounds	Base Neutral Extractable Organic Compounds	Acid Extractable Organic Compounds
Antimony	Acetone	Anthracene	Benzoic Acid
Arsenic	Benzene	Benzo(a)anthracene	P-Chloro-m-cresol
Barium	Chloroethane	Benzo(a)pyrene	2, 4-Dimethylphenol
Beryllium	Chloroform	Benzo(b)fluoranthene	4, 6-Dinitro-o-cresol
Cadmium	Chloromethane	Benzo(k)fluoranthene	Phenol
Chromium	1, 1-Dichloroethane	Bis(2-ethylhexyl phthalate)	
Cobalt	1, 1-Dichloroethene	Chrysene	
Copper	1, 2-Dichloroethane	Dibenzofuran	<b>Field Parameters</b>
Lead	1, 2-Trans-Dichloroethene	Dimethyl Phthalate	Total Dissolved Solids
Nickel	Ethylbenzene	Di-n-butyl Phthalate	pH
Selenium	Methylene Chloride	Fluorene	Specific Conductance
Silver	Tetrachloroethylene	2-Methyl Naphthalene	Temperature
Zinc	1, 1, 1-Trichloroethane	Naphthalene	
Mercury	1, 1, 2-Trichloroethane	Phenanthrene	
**Chromium VI	Trichloroethene	Pyrene	
	Toluene		
	Vinyl Chloride		
	Xylene		

## APPENDIX C

### 2018 Landfill Survey

## Appendix C

### Survey Data for the 2007 Baseline, 2008, 2013, and 2018

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Date	2007	2008	2013	2018
	(baseline)			
MH 2	649.90	649.85	650.30	650.30
CE 1	657.54	657.56	657.48	657.51
CE 2	657.41	657.38	657.36	657.41
CE 3	657.30	657.32	657.25	657.25
CE 4	657.29	657.28	29.38	657.26
CE 5	657.42	657.40	657.35	657.36
CE 6	657.35	657.33	657.33	657.38
CE 7	656.94	656.92	656.90	656.94
CE 8	657.20	657.15	657.14	657.16
North Vent	671.73	671.71	671.64	671.65
South Vent	672.04	672.02	672.01	672.01
MW-101	--	--	653.03	653.08
MW-102	--	--	652.87	653.17
MW-103	--	--	652.03	652.12
MW-104	--	--	655.44	655.29
MW-105	--	--	654.76	654.79

**Notes:**

- (1) MH 2 - is a control point man hole cover located within the landfill perimeter fence.  
(2) CE - Concrete Enclosure that houses the sump outlets for the leachate collection system.

Fifth Five-Year Review  
Sand Springs Petrochemical Complex

# APPENDIX D

## Interviews

## **Background and O&M Interview**

**Site Name:** Sand Springs Petrochemical Complex Superfund Site  
**Location:** Sand Springs, OK

**Date:** 10/22/19

**Name:** Jason Lockett

**Title:** Project Manager

**Organization:** Arcadis

**Phone Number:** 859.287.0410

**Email Address:** Jason.lockett@arcadis.com

### **Background Interview**

**1. What is your overall impression of the project? (general sentiment)**

Good. Protective cap has remained in good shape. Leachate collection has improved since implementation of new leachate removal system.

**2. What effects have site operations had on the surrounding community?**

None

**3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.**

No

**4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.**

In June 2018 someone broke into the site by cutting the front gate lock with bolt cutters. There was no vandalism or theft from the site, however access from the site was used to then cut into a fence leading to the neighboring property, Tulsa Combustion, where some hand tools were stolen. A police report was filed and all damaged site locks and fences were repaired.

**5. Do you feel well informed about the site's activities and progress?**

Yes, field teams provide field notes and photos from each site visit for grounds maintenance, leachate recovery, site inspections, or solar sipper system O&M.

**6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?**

No, management and operation of the site is sufficient and site operations are providing the intended results.

**O&M Interview**

**7. Is the remedy functioning as expected? How well is the remedy performing?**

Yes, the cap has been maintained as intended, leachate recovery activities have been improved to effectively remove leachate, the solar sipper recovery system continues to operate and recover product, and annual groundwater sampling data indicates no groundwater impacts are migrating offsite.

**8. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?**

During the last Mann Kendall trend evaluation for groundwater at the site, many VOC and Metals constituents were shown to have decreasing trends. Additionally, MW-105 which historically contained product has not contained product since at least 1998 and has not contained a sheen since 2012.

**9. Is there a continuous on-site O&M presence? If so, please describe staff activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.**

There is not a full time O&M presence onsite. The site is visited twice monthly for solar sipper O&M where general site inspections are completed. The site is also visited quarterly for leachate recovery and a more in depth site inspection. Additionally, the site is also visited as needed when mowing or other site maintenance is needed.

**10. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.**

No, the O&M requirements and schedule have remained the same with exception to additional or less mowing needs due to rainfall or drought.

**11. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details.**

The dedicated leachate recovery pumps were not operating properly due to age. In 2018 the leachate pumps were pulled and a mobile trailer mounted leachate recovery system was incorporated.



**12. Have there been opportunities to optimize O&M, or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.**

Leachate system O&M improvements have reduced maintenance needs, and improved leachate removal efficiency.

**13. Do you have any comments, suggestions, or recommendations regarding the project?**

Arcadis will review leachate recovery volumes and groundwater analytical data during 2019 site report preparation and may request for review a reduction in leachate recovery or groundwater sampling at select leachate recovery wells or groundwater monitoring wells, respectively, pending data review in the 2019 Annual Report.

## **State and Local Authorities Interview**

**Site Name: Sand Springs Petrochemical Complex**

**Location: Sand Springs, OK**

**Date: November 12, 2019**

**Name: Kelsey Bufford**

**Title: Environmental Programs Specialist III**

**Organization: Oklahoma Department of Environmental Quality**

**Phone Number: 405 702 5184**

**Email Address: kelsey.bufford@deq.ok.gov**

**1. What is your overall impression of the project? (general sentiment)**

Overall, I believe the remedy is performing as designed. The data from the groundwater monitoring reports suggest predominately ongoing stable to declining trends for the main chemicals of concern.

**2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.**

DEQ performed a site inspection for the Fifth Five-Year Review on October 15, 2019. The site inspection indicated that the remedy is performing as intended.

**3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.**

No.

**4. Do you feel well informed about the site's activities and progress?**

Yes. Arcadis personnel continue to keep DEQ well informed about all monitoring and inspection activities via annual progress reports and open communication.

**5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?**

I have no comments, suggestions, or recommendations at this time. Arcadis personnel are doing an excellent job.

## State and Local Authorities Interview

Site Name: Sand Springs Petrochemical Complex  
Location: Sand Springs, OK

Date: December 12-9-2019

Name: Kevin West

Title: Environmental Compliance Administrator

Organization: City of Sand Springs

Phone Number: 918-246-2603

Email Address: [kdwest@sandspringsok.org](mailto:kdwest@sandspringsok.org)

**1. What is your overall impression of the project? (general sentiment)**

I have been involved with this project to some extent since the beginning. So far, it seems to have been relatively well run.

**2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.**

They discharge leachate to the City's POTW about 4 times a year. They call us for permission prior to each discharge with the amount they wish to discharge, usually just a few hundred gallons. They do laboratory analysis of a composite sample and send these to us in their annual report. To date, nothing has appeared in the discharge of concern.

**3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.**

No

**4. Do you feel well informed about the site's activities and progress?**

Relatively so, but I am curious to know how long the site will be required to be monitored.

**5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?**

No

State and Local Authorities Interview

Site Name: Sand Springs Petrochemical Complex

Location: Sand Springs, OK

Date: 11-14-2019

Name: THOMAS H. HARRISON

Title: REAL ESTATE DEPT.

Organization: SAND SPRINGS HOME

Phone Number: 918-245-2131

Email Address: THARRISON@SANDSPRINGSHOME.COM

1. What is your overall impression of the project? (general sentiment) OK
2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results. NONE
3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses. NO
4. Do you feel well informed about the site's activities and progress? YES
5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation? NO

## APPENDIX E

### Leachate Collection Data

## Appendix E

### Leachate System Service - 2015

Sand Springs Petrochemical Complex  
Tulsa County

Cell Number	Type	Date Serviced	Time Serviced		Meter reading		Gallons per Cell	pH
			Start	Finish	Start	Finish		
1	Collection	2/19/2015	9:35	9:37	11,620	11,650	0	NA
1	Detection	2/19/2015	9:38	9:40	11,650	11,650	0	NA
2	Collection	2/19/2015	9:23	9:25	11,560	11,610	0	NA
2	Detection	1/29/1900	14:24	9:30	11,610	11,620	10	NA
3	Collection	2/19/2015	9:45	9:50	11,650	11,730	0	NA
3	Detection	2/19/2015	9:52	9:55	11,730	11,730	0	NA
4	Collection	2/19/2015	9:13	9:15	11,550	11,550	0	NA
4	Detection	2/19/2015	9:17	9:20	11,550	11,560	0	NA
5	Collection	2/19/2015	9:58	10:00	11,730	11,800	0	NA
5	Detection	2/19/2015	10:03	10:05	11,800	11,800	0	NA
6	Collection	2/19/2015	9:00	9:05	11,480	11,550	0	NA
6	Detection	2/19/2015	9:06	9:10	11,550	11,550	0	NA
7	Collection	2/19/2015	10:10	10:13	11,800	11,800	0	NA
7	Detection	2/19/2015	10:14	10:15	11,810	11,820	0	NA
8	Collection	2/19/2015	10:30	10:40	11,820	11,850	30	9.0
8	Detection	2/19/2015	10:20	10:25	11,820	11,820	0	NA
First Quarter Total Gallons Pumped							40	
1	Collection	4/23/2015	10:00	10:05	12,040	12,100	0	NA
1	Detection	4/23/2015	10:07	10:10	12,100	12,100	0	NA
2	Collection	4/23/2015	9:45	9:47	11,940	12,040	0	NA
2	Detection	1/29/1900	14:24	9:53	12,040	12,040	0	NA
3	Collection	4/23/2015	10:15	10:20	12,100	12,200	0	NA
3	Detection	4/23/2015	10:22	10:25	12,200	12,200	0	NA
4	Collection	4/23/2015	9:35	9:37	11,930	11,940	0	NA
4	Detection	4/23/2015	9:38	9:40	11,940	11,940	0	NA
5	Collection	4/23/2015	10:30	10:35	12,200	12,250	0	NA
5	Detection	4/23/2015	10:37	10:40	12,250	12,250	0	NA
6	Collection	4/23/2015	9:20	9:25	11,850	11,930	0	NA
6	Detection	4/23/2015	9:27	9:30	11,930	11,930	0	NA

**Leachate System Service - 2015**  
Sand Springs Petrochemical Complex  
Tulsa County

Cell Number	Type	Date Serviced	Time Serviced		Meter reading		Gallons per Cell	pH
			Start	Finish	Start	Finish		
7	Collection	4/23/2015	10:40	10:43	12,250	12,260	0	NA
7	Detection	4/23/2015	10:45	10:47	12,260	12,260	0	NA
8	Collection	4/23/2015	10:55	11:10	12,260	12,800	475	9.5
8	Detection	4/23/2015	10:50	10:53	12,260	12,260	0	NA
<b>Second Quarter Total Gallons Pumped</b>							<b>475</b>	
1	Collection	8/5/2015	9:55	9:58	13,300	13,400	0	NA
1	Detection	8/5/2015	10:00	10:02	13,400	13,410	0	NA
2	Collection	8/5/2015	9:45	9:48	13,210	13,280	0	NA
2	Detection	1/29/1900	14:24	9:52	13,280	13,300	0	NA
3	Collection	8/5/2015	10:05	10:07	13,410	13,500	0	NA
3	Detection	8/5/2015	10:10	10:12	13,500	13,500	0	NA
4	Collection	8/5/2015	9:10	9:36	12,810	13,200	270	NA
4	Detection	8/5/2015	9:38	9:40	13,200	13,210	0	NA
5	Collection	8/5/2015	10:15	10:18	13,500	13,600	0	NA
5	Detection	8/5/2015	10:20	10:22	13,600	13,600	0	NA
6	Collection	8/5/2015	8:58	9:02	12,800	12,805	0	NA
6	Detection	8/5/2015	9:03	9:05	12,805	12,810	0	NA
7	Collection	8/5/2015	10:25	10:27	13,600	13,610	0	NA
7	Detection	8/5/2015	10:30	10:32	13,610	13,620	0	NA
8	Collection	8/5/2015	10:40	11:50	13,630	14,930	1,200	7.5
8	Detection	8/5/2015	10:35	10:37	13,620	13,630	0	NA
<b>Third Quarter Total Gallons Pumped</b>							<b>1470</b>	
1	Collection	11/24/2015	9:00	9:04	15200	15260	0	NA
1	Detection	11/24/2015	9:05	9:09	15260	15260	0	NA
2	Collection	11/24/2015	8:45	8:47	15110	15200	0	NA
2	Detection	1/29/1900	14:24	8:52	15200	15200	0	NA
3	Collection	11/24/2015	9:12	9:15	15260	15360	0	NA
3	Detection	11/24/2015	9:16	9:20	15360	15360	0	NA

**Leachate System Service - 2015**  
Sand Springs Petrochemical Complex  
Tulsa County

Cell Number	Type	Date Serviced	Time Serviced		Meter reading		Gallons per Cell	pH
			Start	Finish	Start	Finish		
4	Collection	11/24/2015	8:20	8:35	14930	15110	100	NA
4	Detection	11/24/2015	8:36	8:40	15110	15110	0	NA
5	Collection	11/24/2015	9:22	9:25	15360	15430	0	NA
5	Detection	11/24/2015	9:26	9:30	15430	15430	0	NA
6	Collection	11/24/2015	8:07	8:10	14930	14930	0	NA
6	Detection	11/24/2015	8:11	8:15	14930	14930	0	NA
7	Collection	11/24/2015	9:35	9:37	15430	15440	0	NA
7	Detection	11/24/2015	9:38	9:40	15440	15440	0	NA
8	Collection	11/24/2015	9:45	10:15	15550	15750	200	7.5
8	Detection	11/24/2015	9:43	9:44	15440	15550	0	NA
Fourth Quarter Total Gallons Pumped							300	

NA - Not Applicable

Note: In accordance with Sand Springs Pre-Industrial Treatment Program discharge permit, each tank load of leachate was tested as a batch and batches with a pH greater than 9 were adjusted to a pH of 6-9 prior to discharge to the Sand Springs POTW.



### Leachate Collection System Summary and GPAD Statistics, 2015

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Cell Number	Cell Type	Last Date Serviced 2014	Last Date Serviced 2015	Gallons Per Cell	Cell Area in Acres	Decimal Days	GPAD
1	Collection	10/2/2014	11/24/2015	0	1.135	418.00	0.00
1	Detection	10/2/2014	11/24/2015	0	1.135	418.00	0.00
2	Collection	10/2/2014	11/24/2015	0	1.139	418.00	0.00
2	Detection	10/2/2014	11/24/2015	10	1.139	418.00	0.02
3	Collection	10/2/2014	11/24/2015	0	0.89	418.00	0.00
3	Detection	10/2/2014	11/24/2015	0	0.89	418.00	0.00
4	Collection	10/2/2014	11/24/2015	370	0.899	418.00	0.98
4	Detection	10/2/2014	11/24/2015	0	0.899	418.00	0.00
5	Collection	10/2/2014	11/24/2015	0	0.869	418.00	0.00
5	Detection	10/2/2014	11/24/2015	0	0.869	418.00	0.00
6	Collection	10/2/2014	11/24/2015	0	0.881	418.00	0.00
6	Detection	10/2/2014	11/24/2015	0	0.881	418.00	0.00
7	Collection	10/2/2014	11/24/2015	0	1.113	418.00	0.00
7	Detection	10/2/2014	11/24/2015	0	1.113	418.00	0.00
8	Collection	10/2/2014	11/24/2015	1905	1.108	418.00	4.11
8	Detection	10/2/2014	11/24/2015	0	1.108	418.00	0.00
<b>Total Gallons Pumped</b>				<b>2285</b>			

Notes:

- (1) Decimal days were rounded up to the nearest whole day.
- (2) The leachate was collected, sampled and discharged to the Sand Springs POTW. The POTW was notified prior to the discharge, and the leachate was released under a permit issued by the Sand Springs Pre-Industrial Treatment Program

## Leachate System Service - 2016

Sand Springs Petrochemical Complex  
Tulsa County

Cell Number	Type	Date Serviced	Time Serviced		Meter reading		Gallons per Cell	pH
			Start	Finish	Start	Finish		
1	Collection	2/1/2016	10:55	11:00	16,240	16,240	0	9.5
1	Detection	2/1/2016	11:02	11:05	16,240	16,240	0	
2	Collection	2/1/2016	10:40	10:44	16,160	16,180	0	
2	Detection	2/1/2016	10:45	10:50	16,180	16,240	40	
3	Collection	2/1/2016	11:05	11:08	16,240	16,300	0	
3	Detection	2/1/2016	11:10	11:13	16,300	16,300	0	
4	Collection	2/1/2016	10:05	10:30	15,750	16,160	260	
4	Detection	2/1/2016	10:31	10:35	16,160	16,160	0	
5	Collection	2/1/2016	11:10	11:15	16,300	16,350	0	
5	Detection	2/1/2016	11:17	11:20	16,350	16,350	0	
6	Collection	2/1/2016	9:50	9:55	15,750	15,750	0	
6	Detection	2/1/2016	9:56	10:00	15,750	15,750	0	
7	Collection	2/1/2016	11:20	11:23	16,350	16,360	5	
7	Detection	2/1/2016	11:25	11:30	16,360	16,370	0	
8	Collection	2/1/2016	12:40	13:45	16,560	17,850	1200	
8	Detection	2/1/2016	12:15	12:35	16,370	16,560	110	
First Quarter Total Gallons Pumped							1615	
1	Collection	5/16/2016	13:15	13:20	18,130	18,200	0	7.5
1	Detection	5/16/2016	13:23	13:25	18,200	18,210	0	
2	Collection	5/16/2016	10:40	10:45	18,020	18,100	0	
2	Detection	5/16/2016	10:47	10:50	18,100	18,130	30	
3	Collection	5/16/2016	13:30	13:35	18,210	18,300	0	
3	Detection	5/16/2016	13:37	13:40	18,300	18,300	0	
4	Collection	5/16/2016	10:11	10:30	17,850	18,020	125	
4	Detection	5/16/2016	10:33	10:35	18,020	18,020	0	
5	Collection	5/16/2016	13:45	13:50	18,300	18,400	0	
5	Detection	5/16/2016	13:52	13:55	18,400	18,400	0	
6	Collection	5/16/2016	10:00	10:02	17,850	17,850	0	
6	Detection	5/16/2016	10:03	10:05	17,850	17,850	0	

## Leachate System Service - 2016

Sand Springs Petrochemical Complex  
Tulsa County

Cell Number	Type	Date Serviced	Time Serviced		Meter reading		Gallons per Cell	pH
			Start	Finish	Start	Finish		
7	Collection	5/16/2016	14:00	14:05	18,400	18,410	5	
7	Detection	5/16/2016	14:07	14:10	18,410	18,410	0	
8	Collection	5/16/2016	14:20	15:25	18,420	19,560	1020	
8	Detection	5/16/2016	14:15	14:17	18,410	18,420	0	
Second Quarter Total Gallons Pumped							1180	
1	Collection	9/29/2016	11:13	11:18	20,230	20,540	0	9.2
1	Detection	9/29/2016	11:20	11:33	20,540	20,560	10	
2	Collection	9/29/2016	10:37	10:43	19,940	20,220	0	
2	Detection	9/29/2016	10:45	10:51	20,220	20,230	5	
3	Collection	9/29/2016	11:39	11:44	20,560	20,830	0	
3	Detection	9/29/2016	11:46	11:58	20,830	20,850	10	
4	Collection	9/29/2016	9:15	10:20	19,560	19,900	250	
4	Detection	9/29/2016	10:23	10:29	19,900	19,940	0	
5	Collection	9/29/2016	12:06	12:11	20,850	21,100	0	
5	Detection	9/29/2016	12:13	12:23	21,100	21,110	10	
6	Collection	9/29/2016	8:45	8:55	19,560	19,560	0	
6	Detection	9/29/2016	8:55	9:05	19,560	19,560	0	
7	Collection	9/29/2016	12:31	12:36	21,110	21,120	5	
7	Detection	9/29/2016	12:38	12:43	21,120	21,140	0	
8	Collection	9/29/2016	12:51	13:40	21,140	21,500	290	
8	Detection	9/29/2016	13:41	13:53	21,500	21,540	20	
Third Quarter Total Gallons Pumped							600	
1	Collection	11/29/2016	10:38	10:46	22,084	22,532	0	
1	Detection	11/29/2016	10:48	10:58	22,532	22,551	8	
2	Collection	11/29/2016	10:14	10:24	21,610	22,071	0	
2	Detection	11/29/2016	10:25	10:30	22,071	22,084	4	
3	Collection	11/29/2016	11:03	11:08	22,551	22,838	0	
3	Detection	11/29/2016	11:10	11:10	22,838	22,838	0	

**Leachate System Service - 2016**

Sand Springs Petrochemical Complex  
Tulsa County

Cell Number	Type	Date Serviced	Time Serviced		Meter reading		Gallons per Cell	pH
			Start	Finish	Start	Finish		
4	Collection	11/29/2016	9:50	10:00	21,540	21,568	12	8.0
4	Detection	11/29/2016	10:03	10:08	21,568	21,610	0	
5	Collection	11/29/2016	11:15	11:20	22,838	23,058	0	
5	Detection	11/29/2016	11:22	11:32	23,058	23,078	8	
6	Collection	11/29/2016	9:28	9:33	21,540	21,540	0	
6	Detection	11/29/2016	9:34	9:44	21,540	21,540	20	
7	Collection	11/29/2016	11:37	11:42	23,078	23,078	0	
7	Detection	11/29/2016	11:44	11:49	23,078	23,107	0	
8	Collection	11/29/2016	11:55	12:15	23,107	23,172	32	
8	Detection	11/29/2016	12:17	12:32	23,172	23,208	16	
Fourth Quarter Total Gallons Pumped							100	

NA - Not Applicable

Note: In accordance with Sand Springs Pre-Industrial Treatment Program discharge permit, each tank load of leachate was tested as a batch and batches with a pH greater than 9 were adjusted to a pH of 6-9 prior to discharge to the Sand Springs POTW.

### Leachate Collection System Summary and GPAD Statistics, 2016

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Cell Number	Cell Type	Last Date Serviced 2014	Last Date Serviced 2015	Gallons Per Cell	Cell Area in Acres	Decimal Days	GPAD
1	Collection	11/24/2015	11/29/2016	0	1.135	371.00	0.00
1	Detection	11/24/2015	11/29/2016	18	1.135	371.00	0.04
2	Collection	11/24/2015	11/29/2016	0	1.139	371.00	0.00
2	Detection	11/24/2015	11/29/2016	79	1.139	371.00	0.19
3	Collection	11/24/2015	11/29/2016	0	0.89	371.00	0.00
3	Detection	11/24/2015	11/29/2016	10	0.89	371.00	0.03
4	Collection	11/24/2015	11/29/2016	647	0.899	371.00	1.94
4	Detection	11/24/2015	11/29/2016	0	0.899	371.00	0.00
5	Collection	11/24/2015	11/29/2016	0	0.869	371.00	0.00
5	Detection	11/24/2015	11/29/2016	18	0.869	371.00	0.06
6	Collection	11/24/2015	11/29/2016	0	0.881	371.00	0.00
6	Detection	11/24/2015	11/29/2016	20	0.881	371.00	0.06
7	Collection	11/24/2015	11/29/2016	15	1.113	371.00	0.04
7	Detection	11/24/2015	11/29/2016	0	1.113	371.00	0.00
8	Collection	11/24/2015	11/29/2016	2542	1.108	371.00	6.18
8	Detection	11/24/2015	11/29/2016	146	1.108	371.00	0.36
<b>Total Gallons Pumped</b>				<b>3495</b>			

Notes:

- (1) Decimal days were rounded up to the nearest whole day.
- (2) The leachate was collected, sampled and discharged to the Sand Springs POTW. The POTW was notified prior to the discharge, and the leachate was released under a permit issued by the Sand Springs Pre-Industrial Treatment Program

## Leachate System Service - 2017

Sand Springs Petrochemical Complex  
Tulsa County

Cell Number	Type	Date Serviced	Time Serviced		Meter reading		Gallons per Cell	pH
			Start	Finish	Start	Finish		
1	Collection	2/15/2017	10:36	10:41	23,408	23,550	0	7.5
1	Detection	2/15/2017	10:42	10:47	23,550	23,562	0	
2	Collection	2/15/2017	10:18	10:23	23,230	23,390	0	
2	Detection	2/15/2017	10:25	10:30	23,390	23,408	22	
3	Collection	2/15/2017	10:53	10:58	23,562	23,576	0	
3	Detection	2/15/2017	10:59				0	
4	Collection	2/15/2017	9:55	10:05	23,209	23,210	1	
4	Detection	2/15/2017	10:08	10:13	23,210	23,230	0	
5	Collection	2/15/2017	11:05	11:10	23,576	23,576	0	
5	Detection	2/15/2017	11:12	11:27	23,576	23,603	27	
6	Collection	2/15/2017	9:35	9:40	23,207	23,207	0	
6	Detection	2/15/2017	9:41	9:51	23,207	23,209	2	
7	Collection	2/15/2017	11:34	11:40	23,603	23,610	0	
7	Detection	2/15/2017	11:41	11:46	23,610	23,630	0	
8	Collection	2/15/2017	11:51	12:08	23,630	23,665	35	
8	Detection	2/15/2017	12:09	12:31	23,665	23,706	41	
First Quarter Total Gallons Pumped							128	
1	Collection	6/21/2017	9:29	9:37	24,029	24,089	0	7.9
1	Detection	6/21/2017	9:38	9:50	24,089	24,096	7	
2	Collection	6/21/2017	9:05	9:12	23,926	24,029	0	
2	Detection	6/21/2017	9:13	9:20	24,029	24,029	0	
3	Collection	6/21/2017	9:55	10:05	24,096	24,099	0	
3	Detection	6/21/2017			0	0	0	
4	Collection	6/21/2017	8:40	8:52	23,703	23,883	180	
4	Detection	6/21/2017	8:53	9:00	23,883	23,926	0	
5	Collection	6/21/2017	10:30	10:37	24,099	24,165	0	
5	Detection	6/21/2017	10:38	10:44	24,165	24,165	0	
6	Collection	6/21/2017	8:23	8:29	23,705	23,705	0	
6	Detection	6/21/2017	8:30	8:36	23,705	23,705	0	

## Leachate System Service - 2017

Sand Springs Petrochemical Complex  
Tulsa County

Cell Number	Type	Date Serviced	Time Serviced		Meter reading		Gallons per Cell	pH
			Start	Finish	Start	Finish		
7	Collection	6/21/2017	10:48	10:55	24,165	24,226	0	
7	Detection	6/21/2017	10:56	11:05	24,226	24,240	0	
8	Collection	6/21/2017	11:10				0	
8	Detection	6/21/2017	11:20	11:43	24,240	24,296	56	
Second Quarter Total Gallons Pumped							243	
1	Collection	9/27/2017	10:19	10:26	24,480	24,589	0	7.7
1	Detection	9/27/2017	10:27	10:36	24,589	24,589	0	
2	Collection	9/27/2017	9:42	9:45	24,472	24,472	0	
2	Detection	9/27/2017	9:46	9:57	24,472	24,480	0	
3	Collection	9/27/2017					0	
3	Detection	9/27/2017					0	
4	Collection	9/27/2017	9:18	9:33	24,296	24,472	176	
4	Detection	9/27/2017	9:34	9:40	24,472	24,472	0	
5	Collection	9/27/2017	10:38	10:45	24,589	24,785	0	
5	Detection	9/27/2017	10:46	10:55	24,785	24,785	0	
6	Collection	9/27/2017	9:00	9:09	24,290	24,296	0	
6	Detection	9/27/2017	9:10	9:16	24,296	24,296	0	
7	Collection	9/27/2017	10:57	11:03	24,285	24,825	0	
7	Detection	9/27/2017	11:04	11:10	24,825	24,841	0	
8	Collection	9/27/2017					0	
8	Detection	9/27/2017	11:15	11:30	24,841	24,845	4	
Third Quarter Total Gallons Pumped							180	
1	Collection	11/7/2017	9:57	10:02	25,188	25,370	50	
1	Detection	11/7/2017	10:04	10:09	25,370	25,370	0	
2	Collection	11/7/2017	9:42	9:42	25,146	25,146	0	
2	Detection	11/7/2017	9:45	9:52	25,146	25,188	12	
3	Collection	11/7/2017						
3	Detection	11/7/2017						

## Leachate System Service - 2017

Sand Springs Petrochemical Complex  
Tulsa County

Cell Number	Type	Date Serviced	Time Serviced		Meter reading		Gallons per Cell	pH
			Start	Finish	Start	Finish		
4	Collection	11/7/2017	8:41	9:35	24,865	25,146	75	8.0
4	Detection	11/7/2017	9:37	9:42	25,146	25,146	0	
5	Collection	11/7/2017	10:11	10:16	25,370	25,568	55	
5	Detection	11/7/2017	10:17	10:22	25,568	25,568	0	
6	Collection	11/7/2017	8:20	8:31	24,844	24,865	11	
6	Detection	11/7/2017	8:33	8:38	24,865	24,865	0	
7	Collection	11/7/2017	10:24	10:29	25,568	25,739	45	
7	Detection	11/7/2017	10:30	10:35	25,739	25,761	5	
8	Collection	11/7/2017						
8	Detection	11/7/2017	10:39	11:02	25,761	25,789	7	
Fourth Quarter Total Gallons Pumped							260	

NA - Not Applicable

Note: In accordance with Sand Springs Pre-Industrial Treatment Program discharge permit, each tank load of leachate was tested as a batch and batches with a pH greater than 9 were adjusted to a pH of 6-9 prior to discharge to the Sand Springs POTW.



### Leachate Collection System Summary and GPAD Statistics, 2017

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Cell Number	Cell Type	Last Date Serviced 2014	Last Date Serviced 2015	Gallons Per Cell	Cell Area in Acres	Decimal Days	GPAD
1	Collection	11/29/2016	11/7/2017	50	1.135	343.00	0.13
1	Detection	11/29/2016	11/7/2017	7	1.135	343.00	0.02
2	Collection	11/29/2016	11/7/2017	0	1.139	343.00	0.00
2	Detection	11/29/2016	11/7/2017	34	1.139	343.00	0.09
3	Collection	11/29/2016	11/7/2017	0	0.89	343.00	0.00
3	Detection	11/29/2016	11/7/2017	0	0.89	343.00	0.00
4	Collection	11/29/2016	11/7/2017	432	0.899	343.00	1.40
4	Detection	11/29/2016	11/7/2017	0	0.899	343.00	0.00
5	Collection	11/29/2016	11/7/2017	55	0.869	343.00	0.18
5	Detection	11/29/2016	11/7/2017	27	0.869	343.00	0.09
6	Collection	11/29/2016	11/7/2017	11	0.881	343.00	0.04
6	Detection	11/29/2016	11/7/2017	2	0.881	343.00	0.01
7	Collection	11/29/2016	11/7/2017	45	1.113	343.00	0.12
7	Detection	11/29/2016	11/7/2017	5	1.113	343.00	0.01
8	Collection	11/29/2016	11/7/2017	35	1.108	343.00	0.09
8	Detection	11/29/2016	11/7/2017	108	1.108	343.00	0.28
<b>Total Gallons Pumped</b>				<b>811</b>			

Notes:

- (1) Decimal days were rounded up to the nearest whole day.
- (2) The leachate was collected, sampled and discharged to the Sand Springs POTW. The POTW was notified prior to the discharge, and the leachate was released under a permit issued by the Sand Springs Pre-Industrial Treatment Program

**Leachate System Service - 2018**  
**Sand Springs Petrochemical Complex**  
**Tulsa County**

Cell Number	Type	Date Serviced	Time Served		Meter reading		Gallons per Cell	pH	
			Start	Finish	Start	Finish			
1	Collection	3/15/2018	9:10	9:12	25,847	25,847	0	8.1	
1	Detection	3/15/2018	9:19	9:19	25,847	25,849	0		
2	Collection	3/15/2018	8:48	8:49	25,806	25,806	0		
2	Detection	3/15/2018	8:51	9:04	25,806	25,847	41		
3	Collection	3/15/2018	Inoperable, Pump Removed						
3	Detection	3/15/2018	Inoperable, Pump Removed						
4	Collection	3/15/2018	8:30	8:35	25,788	25,788	0		
4	Detection	3/15/2018	8:37	8:45	25,788	25,806	0		
5	Collection	3/15/2018	9:24	9:29	25,849	25,849	0		
5	Detection	3/15/2018	9:32	9:43	25,849	25,855	6		
6	Collection	3/15/2018	8:15	8:20	25,788	25,788	0		
6	Detection	3/15/2018	8:22	8:27	25,788	25,788	0		
7	Collection	3/15/2018	9:53	9:59	25,855	25,942	0		
7	Detection	3/15/2018	10:01	10:13	25,942	25,954	12		
8	Collection	3/15/2018	10:18	10:19	25,954	25,954	0		
8	Detection	3/15/2018	10:21	10:40	25,954	25,966	12		
First Quarter Total Gallons Pumped							71		
1	Collection	6/13/2018	9:45	9:48	1,276.5	1,276.5	0	7.9	
1	Detection	6/13/2018	9:50	9:52	1,276.5	1,276.5	0		
2	Collection	6/13/2018	9:17	9:20	1,199.3	1,199.3	0		
2	Detection	6/13/2018	9:23	9:35	1,199.3	1,276.5	77.2		
3	Collection	6/13/2018	9:56	9:57	1,276.5	1,276.5	0		
3	Detection	6/13/2018	9:59	10:01	1,276.5	1,276.5	0		
4	Collection	6/13/2018	8:04	8:46	838.9	1,199.3	360.4		
4	Detection	6/13/2018	8:49	8:51	1,199.3	1,199.3	0		
5	Collection	6/13/2018	10:05	10:08	1,276.5	1,276.5	0		
5	Detection	6/13/2018	10:14	10:37	1,276.5	1,445.2	168.7		
6	Collection	6/13/2018	13:53	13:55	348.9	348.9	0		
6	Detection	6/13/2018	14:03	14:05	348.9	348.9	0		
7	Collection	6/13/2018	10:44	10:47	1,445.2	1,445.2	0		
7	Detection	6/13/2018	10:49	11:10	1,445.2	1,445.2	169		
8	Collection	6/13/2018	14:15	15:18	348.9	838.9	490		
8	Detection	6/13/2018	7:52	7:55	838.9	838.9	0		

**Leachate System Service - 2018**  
**Sand Springs Petrochemical Complex**  
**Tulsa County**

Cell Number	Type	Date Serviced	Time Served		Meter reading		Gallons per Cell	pH
			Start	Finish	Start	Finish		
Second Quarter Total Gallons Pumped							1265.3	
1	Collection	9/6/2018	10:04	10:06	1,791.1	1,791.1	0	Batch 1: Cells 1-7 = 311 gallons @ 7.8 pH Batch 2: Cell 8 = 310.2 gallons @ 9.5 pH
1	Detection	9/6/2018	10:09	10:11	1,791.1	1,791.1	0	
2	Collection	9/6/2018	9:48	9:50	1,791.1	1,791.1	0	
2	Detection	9/6/2018	9:54	9:54	1,791.1	1,791.1	0	
3	Collection	9/6/2018	10:16	10:18	1,791.1	1,791.1	0	
3	Detection	9/6/2018	10:20	10:23	1,791.1	1,791.1	0	
4	Collection	9/6/2018	9:11	9:32	1,614.2	1,791.1	176.9	
4	Detection	9/6/2018	9:35	9:38	1,791.1	1,791.1	0	
5	Collection	9/6/2018	10:28	10:30	1,791.1	1,791.1	0	
5	Detection	9/6/2018	10:33	10:49	1,791.1	1,925.2	134.1	
6	Collection	9/6/2018	8:55	8:57	1,614.2	1,614.2	0	
6	Detection	9/6/2018	8:59	9:02	1,614.2	1,614.2	0	
7	Collection	9/6/2018	10:55	10:58	1,925.2	1,925.2	0	
7	Detection	9/6/2018	11:00	11:03	1,925.2	1,925.2	0	
8	Collection	9/6/2018	11:32	12:05	1,925.2	2,235.4	310.2	
8	Detection	9/6/2018	12:07	12:10	2,235.4	2,235.4	0	
Third Quarter Total Gallons Pumped							621.2	
1	Collection	11/1/2018	11:11	11:13	2,719.2	2,719.2	0	Batch 1: 483.7 gallons @ 8.6 pH Batch 2: 137.7 gallons @ 8.8 pH
1	Detection	11/1/2018	11:15	11:17	2,719.2	2,719.2	0	
2	Collection	11/1/2018	11:03	11:05	2,719.2	2,719.2	0	
2	Detection	11/1/2018	11:07	11:09	2,719.2	2,719.2	0	
3	Collection	11/1/2018	11:22	11:24	2,719.2	2,719.2	0	
3	Detection	11/1/2018	11:27	11:29	2,719.2	2,719.2	0	
4	Collection	11/1/2018	10:50	10:53	2,719.2	2,719.2	0	
4	Detection	11/1/2018	10:54	11:00	2,719.2	2,719.2	0	
5	Collection	11/1/2018	11:33	11:35	2,719.2	2,719.2	0	
5	Detection	11/1/2018	11:37	11:56	2,719.2	2,846.6	127.4	
6	Collection	11/1/2018	8:42	9:10	2,235.5	2,442.0	206.5	
6	Detection	11/1/2018	9:15	9:58	2,442.0	2,719.2	277.2	
7	Collection	11/1/2018	11:59	12:02	2,846.6	2,846.6	0	
7	Detection	11/1/2018	12:04	12:06	2,846.6	2,846.6	0	
8	Collection	11/1/2018	12:11	12:26	2,846.6	2,956.9	110.3	
8	Detection	11/1/2018	12:29	12:31	2,956.9	2,956.9	0	
Fourth Quarter Total Gallons Pumped							721.4	

NA - Not Applicable

Note: In accordance with Sand Springs Pre-Industrial Treatment Program discharge permit, each tank load of leachate was tested as a batch and batches with a pH

### Leachate Collection System Summary and GPAD Statistics, 2018

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Cell Number	Cell Type	Last Date Serviced 2017	Last Date Serviced 2018	Gallons Per Cell	Cell Area in Acres	Decimal Days	GPAD
1	Collection	11/7/2017	11/1/2018	0	1.135	359.00	0.00
1	Detection	11/7/2017	11/1/2018	0	1.135	359.00	0.00
2	Collection	11/7/2017	11/1/2018	0	1.139	359.00	0.00
2	Detection	11/7/2017	11/1/2018	118.2	1.139	359.00	0.29
3	Collection	11/7/2017	11/1/2018	0	0.89	359.00	0.00
3	Detection	11/7/2017	11/1/2018	0	0.89	359.00	0.00
4	Collection	11/7/2017	11/1/2018	537.3	0.899	359.00	1.66
4	Detection	11/7/2017	11/1/2018	0	0.899	359.00	0.00
5	Collection	11/7/2017	11/1/2018	0	0.869	359.00	0.00
5	Detection	11/7/2017	11/1/2018	436.2	0.869	359.00	1.40
6	Collection	11/7/2017	11/1/2018	206.5	0.881	359.00	0.65
6	Detection	11/7/2017	11/1/2018	277.2	0.881	359.00	0.88
7	Collection	11/7/2017	11/1/2018	0	1.113	359.00	0.00
7	Detection	11/7/2017	11/1/2018	181	1.113	359.00	0.45
8	Collection	11/7/2017	11/1/2018	910.5	1.108	359.00	2.29
8	Detection	11/7/2017	11/1/2018	12	1.108	359.00	0.03
<b>Total Gallons Pumped</b>				<b>2679</b>			

Notes:

- (1) Decimal days were rounded up to the nearest whole day.
- (2) The leachate was collected, sampled and discharged to the Sand Springs POTW. The POTW was notified prior to the discharge, and the leachate was released under a permit issued by the Sand Springs Pre-Industrial Treatment Program

## APPENDIX F

### Leachate GPAD Data

## Appendix F

### Comparative Statistics for Collection Cell GPAD, 2002 to 2018

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Collection Cell								
Year	1	2	3	4	5	6	7	8
2002	2.54	1.55	1.57	1.74	0.00	0.64	0.00	4.22
2003	2.08	0.79	2.64	0.61	0.00	0.02	0.00	3.80
2004	0.00	0.00	1.04	2.03	0.03	0.41	0.51	5.43
2005	0.02	0.10	0.74	1.13	0.00	0.48	0.54	3.65
2006	0.95	0.50	29.38	31.60	0.00	0.54	1.14	5.07
2007	0.73	0.42	0.31	1.94	0.06	0.69	0.53	7.98
2008	0.36	0.05	0.06	0.58	0.05	0.89	0.05	4.29
2009	0.21	0.61	0.21	1.09	0.14	0.17	0.44	5.43
2010	0.04	0.06	0.36	1.10	0.13	1.01	0.04	3.83
2011	0.00	0.00	0.13	0.90	0.00	0.00	0.05	6.08
2012	0.00	0.02	0.00	0.69	0.00	0.00	0.00	8.62
2013	0.00	0.01	0.00	0.44	0.00	0.00	0.00	5.06
2014	0.00	0.01	0.00	0.00	0.00	0.00	0.00	2.43
2015	0.00	0.00	0.00	0.98	0.00	0.00	0.00	4.11
2016	0.00	0.00	0.00	1.94	0.00	0.00	0.04	6.18
2017	0.13	0.00	0.00	1.40	0.18	0.04	0.12	0.09
2018	0.00	0.29	0.00	1.66	1.40	1.53	0.45	2.32

values reported in GAPD (gallons/acre/day)

Fifth Five-Year Review  
Sand Springs Petrochemical Complex

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## APPENDIX G

### Groundwater Monitoring Results

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Metals (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
Arsenic	12/95	NS	NS	5D	5D	17	6	55	5D	13	
	3/96	5D	5D	7	5D	5	16	36	5D	5	
	6/97	5D	5D	5D	5D	12	5D	10	5D	5D	
	6/98	5D	5D	5D	5D	26	8	30	5D	5D	
	6/99	5D	5D	5D	47	32	7	25	5D	6	
	6/00	9	5D	5D	5D	6	7	17	5D	25	
	6/01	10	6	5D	5D	18	12	36	5D	26	
	7/02	85D	85D	85D	85D	85D	85D	85D	85D	85D	
	6/03	11	25.6	9.38	9.44	311	21	51.2	15.2	22	
	6/04	10D	12.0	10D	10D	26.4	18.0	20.0	10D	10D	
	6/05	10D	19	10D	10D	57	10D	28.6	10D	14.7	
	6/06	10D	11.9	13.1	20.4	1310	10D	28.6	10D	106	
	6/07	10D	10D	10D	10D	28.2	19.8	54.6	10D	10D	
	10/07				MW-119 resampled October 2007						73.2
	6/08	10D	10D	10D	10D	10D	83	10D	10D	10D	
	6/09	10D	11.4	10D	10D	10D	11.1	42.6	10D	28.3	
	6/10	10D	19.4	10D	10D	10D	10D	36.0	10D	12.2	
	6/11	10D	10D	10D	10D	10D	11.8	23.6	10D	10D	
	6/12	10D	10D	10D	10D	10D	10.0	11.1	10D	10D	
	5/13	10D	10D	10D	10D	10D	10D	13.9	10D	10D	
	4/14	10D	10D	10D	10D	10D	10D	14.7	10D	10D	
	4/15	10D	10D	10D	10D	10D	13.8	12.3	10D	12.4	
	6/16	10D	10D	10D	10D	10D	14.2	23.2	10D	10D	
	5/17	10D	10D	10D	10D	10D	38.0	16.3	10D	10D	
	5/18 & 6/18	NA	10D	10D	10D	30.7	10D	20.7	10D	10D	10D
Barium	12/95	NS	NS	1550	129	1630	1620	1520	153	212	
	3/96	439	228	801	143	843	3680	1660	65	137	
	6/97	232	182	187	117	298	763	78	29	78	
	6/98	283	179	149	214	509	822	303	128	51	
	6/99	224	131	114	726	540	730	260	40	33	
	6/00	696	179	113	147	502	756	328	135	260	
	6/01	269	213	102	228	386	906	131	50	307	
	7/02	683	272	153	154	667	96.4	859	39	44.7	
	6/03	507	499	235	176	2550	926	207	32.6	33.4	
	6/04	307	507	200D	205	429	880	284	200D	200D	
	6/05	399	479	273	286	811	1100	548	68	462	
	6/06	681	408	195	1050	12000	875	329	164	91.6	
	6/07	488	302	200D	200D	604	268	200D	200D	200D	
	10/07				MW-119 resampled October 2007						574
	6/08	488	232	203	93.3	165	894	57.2	47.5	24.7	5160
	6/09	252	278	118	193	147	885	134	48.3	140	485
	6/10	299	415	142	184	304	887	195	69	163	777
	6/11	149	158	110	162	546	785	489	61.2	36.2	638
	6/12	158	134	112	116	179	674	101	68.0	26.0	207
	5/13	189	140	108	112	294	832	126	64.6	37.8	405
	4/14	220	199	107	146	356	772	445	57.5	29.7	289
	4/15	242	158	102	329	53.4	1080	176	37.9	341	448
	6/16	122	155	96.7	80.7	175	1710	445	61.0	28.9	20.3
	5/17	298	169	101.0	92.4	157	456	131	83.7	39.0	226
	5/18 & 6/18	NA	170	99.7	123	1580	850	511	73.9	45	734
Beryllium	12/95	NS	NS	5D	5D	5D	5D	5D	5D	5D	
	3/96	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/97	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/98	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/99	4D	4D	4D	4D	4D	4D	4D	4D	4D	
	6/00	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	6/01	4D	4D	4D	4D	4D	4D	4D	4D	4D	
	7/02	1.2	1D	1.31	1D	1.86	9.43	1D	1D	1.46	
	6/03	1.23	1.71	1.89	1D	3.55	1D	1.64	1.3	2.78	
	6/04	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/05	4D	4D	4	4D	4D	4D	4D	4D	4.3	
	6/06	4D	4D	23.7	4D	17.1	4D	4D	4D	9.7	
	6/07	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	10/07				MW-119 resampled October 2007						6.12
	6/08	1D	1D	1D	1D	1D	1D	1D	1D	3.2	
	6/09	1D	1.3	1D	1D	1D	1D	1D	1D	6.4	
	6/10	1D	1.5	1D	1D	1D	1D	1D	1D	3.7	
	6/11	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/12	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/13	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	4/14	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	4/15	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/16	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/17	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/18 & 6/18	NA	1D	1D	1D	1D	1D	1D	1D	1D	1D
Cadmium	12/95	NS	NS	0.6	0.5D	1.7	2.8	1.7	3.0	1.9	
	3/96	5.9	0.5D	0.5D	0.5D	0.5D	13	1.2	2.4	1.2	
	6/97	1.1	0.5D	0.5D	0.5D	0.5D	0.6	2	0.7	0.7	
	6/98	6	4D	4D	4D	4D	4	4D	6	4D	
	6/99	11	1D	1D	1D	1D	1D	1D	1D	1D	



## Appendix G

## LABORATORY ANALYTICAL RESULTS - Metals (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
	6/00	7	1D	1D	1D	1D	1D	1D	4	1D	MW 119 installed 2007
	6/01	1	1D	1D	1D	1D	1D	1	2.5	1D	
	7/02	5D	5D	5D	5D	5D	9.03	5D	5D	5D	
	6/03	2.27	1D	1D	1D	11.1	1D	1D	1D	1D	
	6/04	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/05	2.2	1.1	1D	1D	1D	1D	1D	1D	0.2	
	6/06	3	2.8	1D	1D	1D	1D	1D	1D	1D	
	6/07	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	10/07	MW-119 resampled October 2007									
	6/08	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/09	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/10	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/11	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/12	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	5/13	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	4/14	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	4/15	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/16	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	5/17	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	5/18 & 6/18	NA	5D	5D	5D	5D	5D	5D	5D	5D	
Chromium	12/95	NS	NS	31	5D	38	8	78	5D	5D	
	3/96	10	5D	15	5D	18	47	75	5D	5D	
	6/97	12	5D	5D	5D	5D	5D	5D	5D	5D	
	6/98	5D	8	5D	5D	5D	5D	18	5D	5D	
	6/99	9	5D	5D	24	11	5D	5D	5D	5D	
	6/00	42	5	5D	5D	10	5D	5D	6	8	MW 119 installed 2007
	6/01	21	8	5D	5D	8	5D	14	5D	10	
	7/02	10.3	7D	7D	7D	40.4	7D	7D	7D	7D	
	6/03	40.2	36.4	5D	5D	23.3	5D	18.9	5D	5D	
	6/04	22.9	42.2	10D	10D	10D	10D	10D	10D	10D	
	6/05	16.2	28.5	6	5D	15	5D	5D	5D	14.8	
	6/06	9.4	25.7	13.7	31.4	88.4	5D	5D	5D	10.7	
	6/07	22	18.0	10D	10D	25.6	10D	10D	10D	10D	
	10/07	resampled October 2007									
	6/08	7.2	12.9	5D	5D	5D	5D	5D	5D	5D	
	6/09	10.9	19.8	5D	5D	5D	5D	5D	5D	7.6	
	6/10	15.2	28.9	5D	5D	5D	5D	5D	5D	6.5	
	6/11	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/12	6.2	5D	5D	5D	5D	5D	5D	5D	5D	
	5/13	8.2	5D	5D	5D	5D	5D	5D	5D	5D	
	4/14	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	4/15	8.2	5D	5D	5D	5D	5D	5D	5D	5D	
	6/16	5D	5D	5D	5D	5D	5.7	5D	5D	5D	
	5/17	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	5/18 & 6/18	NA	5D	5D	5D	5D	5D	5D	5D	5D	
Hexavalent Chromium	12/95	NS	NS	50D	50D	50D	50D	50D	50D	50D	
	3/96	50D	50D	50D	50D	50D	50D	50D	50D	50D	
	6/97	50D	50D	50D	50D	50D	50D	50D	50D	50D	
	6/98	10D	10D	10D	10D	10D	10D	16	10D	10D	
	8/98	MW-105 was resampled for hexavalent chromium, results were non-detect									
	6/99	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/00	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/01	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	7/02	10D	10D	12.7	10D	10D	10D	10D	10D	28.2	MW 119 installed 2007
	6/03	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/04	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/05	10D	68	10D	117	10D	10D	60	10D	10D	
	6/06	10D	10D	10D	10D	217	10D	10D	10D	10D	
Hexavalent Chromium will be analyzed only if total Chromium concentrations exceed 100 mg/L.											
Copper	12/95	NS	NS	25	10D	41	22	35	10D	10D	
	3/96	10	10D	14	10D	16	67	36	10D	10D	
	6/97	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/98	10D	10D	10D	10D	10D	10D	10	10D	10D	
	6/99	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/00	NA	NA	NA	NA	NA	NA	NA	NA	NA	MW 119 installed 2007
	6/01	12	10D	10D	10D	10D	10D	10D	10D	10D	
	7/02	18.8	10D	10D	10D	10.3	51.4	10D	10.5	10D	
	6/03	26.5	20.3	5D	5D	51.7	5D	35.3	6.1	5D	
	6/04	16.1	25.1	10D	10D	10D	10D	10D	10D	10D	
	6/05	14.4	18.6	10D	10D	10D	10D	10D	10D	10D	
	6/06	20.7	16.7	10D	19.8	185	10D	15.6	10D	10D	
	6/07	22.5	10D	10D	10D	22.4	10D	10D	10D	10D	
	10/07	MW-119 resampled October 2007									
	6/08	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/09	10.4	12	10D	10D	10D	10D	10D	10D	10.4	
	6/10	14.5	17.1	10D	10D	10D	10D	10D	10D	10D	
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/12	11.8	10D	10D	10D	10D	10D	10D	10D	10D	
	5/13	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Metals (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
	4/15	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/16	10D	10D	10D	10D	10D	10D	42.4	10D	10D	10D
	5/17	10D	11.4	10D	10D	10D	11.0	10.3	10D	10D	10D
	5/18 & 6/18	NA	10D	10D	10D	10D	10D	10D	10D	10D	10D
Lead	12/95	NS	NS	62	2D	36	15	43	3	5	
	3/96	17	28	33	2D	12	47	43	2	3	
	6/97	10	8	3	2D	2D	2D	2D	2D	2D	
	6/98	11	7	2D	4	0.9	2D	0.5	3	2D	
	6/99	14	4	3D	10	6	3D	3D	3D	3D	
	6/00	69	4	3D	3D	3D	3D	3D	4	3D	
	6/01	21	10	3D	3D	3D	3D	3D	3D	3D	
	7/02	50D	50D	50D	50D	50D	50D	50D	50D	50D	
	6/03	31	38.3	3D	3D	5.12	3D	3D	4.09	3D	
	6/04	19.3	49.8	3.2	3D	4.2	3D	3D	3D	3D	
	6/05	24.9	40.4	7	6.3	9	6.8	5D	5D	19.9	
	6/06	5D	28.4	5D	35.2	51	5D	5D	7.3	5.3	
	6/07	31.5	25.8	5D	6.76	18.5	7.32	5D	5D	12.3	5D
	10/07	resampled October 2007									
	6/08	10.8	17	5.6	5D	5D	5D	5D	5D	5D	197
	6/09	21.3	24.6	5D	5D	5D	5D	5D	5D	5D	11.4
	6/10	31.1	44.7	5D	5D	5.2	5D	5D	5D	6.6	15.6
	6/11	5D	5D	5D	5D	5D	5D	5D	5D	5D	5.3
	6/12	5D	5D	5D	5D	5D	5D	5D	5D	5D	5D
	5/13	5D	5D	5D	5D	5D	5D	5D	5D	5D	5D
	4/14	6.4	5D	5D	5D	5D	5D	5D	5D	5D	5D
	4/15	5D	5D	5D	5D	5D	5D	5D	5D	5.5	5D
	6/16	5D	5D	5D	5D	5D	5D	6.8	5D	5D	5D
	5/17	5D	5D	5D	5D	5D	5D	5D	5D	5D	5D
	5/18 & 6/18	NA	10D	10D	10D	10D	10D	10D	10D	10D	10D
Mercury	12/95	NS	NS	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	
	3/96	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	
	6/97	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	
	6/98	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
	8/98	1 for mercury, results were non-detect									
	6/99	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	
	6/00	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	
	6/01	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	
	7/02	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	
	6/03	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	
	6/04	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	
	6/05	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	
	6/06	0.203	0.2D	0.2D	0.2D	0.205	0.2D	0.2D	0.2D	0.2D	
	6/07	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D
	10/07	resampled October 2007									
	6/08	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D
	6/09	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D
	6/10	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D
	6/11	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D
	6/12	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D
	5/13	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D
	4/14	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D
	4/15	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D
	6/16	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D
	5/17	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D
	5/18 & 6/18	NA	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D	0.2D
Nickel	12/95	NS	NS	43	20D	64	20D	43	50	98	
	3/96	46	20D	25	20D	32	47	51	53	75	
	6/97	20D	20D	20D	20D	20D	20D	50	27	35	
	6/98	22	20D	20D	20D	20D	20D	33	196	79	
	6/99	19	10D	18	27	14	10D	10D	103	77	
	6/00	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	6/01	28	11	10D	10D	10D	10D	25	68	32	
	7/02	74.6	30D	30D	30D	176	30D	46	30D		
	6/03	56.2	54.6	12.2	5D	39.7	5D	10.1	23.1	18.4	
	6/04	40D	56.5	40D	40D	40D	40D	40D	40D	40D	
	6/05	35.5	50.7	10D	10D	10D	10D	16.5	53.1		
	6/06	76	71.4	10D	44.2	338	10D	18.9	19	10D	
	6/07	46.4	40D	40D	40D	40D	40D	40D	40D	40D	40D
	10/07	resampled October 2007									
	6/08	15.5	21.1	6.5	5D	9.3	5D	17.5	10.4	63	204
	6/09	27.7	28.1	5D	6.2	10.1	5D	10.5	12.1	8.6	13.1
	6/10	31.1	41.1	5D	5D	5D	5D	9.8	10.2	53.9	12.1
	6/11	5D	5.9	5D	5D	5D	5D	5.1	8.0	5D	5.0
	6/12	14.6	5D	5D	5D	24.4	5D	31.0	7.8	5D	5D
	5/13	39.9	5D	5D	5D	63.2	5D	9.2	5D	5D	5D
	4/14	18.1	7.9	5D	5D	7.4	5D	5D	5D	5D	5D
	4/15	17.4	5D	5D	8.1	5D	5D	6.2	5D	5D	5D
	6/16	5D	5D	5.5	5.5	9.4	5.1	8.6	5D	29.3	6.9
	5/18 & 6/18	NA	5D	5D	5D	5D	5D	5D	5D	5D	5D

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Metals (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
Selenium	12/95	NS	NS	5D	8	NS	NS	NS	NS	NS	
	3/96	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/97	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/98	20D	20D	20D	20D	20D	20D	20D	20D	20D	
	6/99	8	5D	5D	5D	5D	5D	5D	5D	5D	
	6/00	12	6	7	9	5D	5D	5D	6	9	
	6/01	5D	11	5D	14	5D	5D	5D	5D	5D	
	7/02	100D	100D	100D	100D	100D	100D	100D	100D	100D	
	6/03	9.56	7.78	6.30	6.97	5D	5D	5D	9.3	11.2	
	6/04	27.9	33.7	13.2	32.4	22.9	17.4	10D	23.0	17.3	
	6/05	12.3	10D	10D	10D	10D	10D	10D	10D	10D	
	6/06	11.3	10D	12.7	10	29.6	10D	10D	10D	10.2	
	6/07	35D	35D	35D	35D	35D	35D	35D	35D	35D	
	10/07				MW-119 resampled October 2007						35D
	6/08	15D	15D	15D	15D	15D	15D	15D	15D	15D	
	6/09	15D	15D	15D	15D	15D	15D	15D	15D	15D	
	6/10	15D	15D	15D	15D	15D	15D	15D	15D	15D	
	6/11	15D	15D	16.7	15D	15D	15D	15D	15D	15D	
	6/12	15D	15.6	19.7	18.9	15D	15D	15D	15D	15D	
	5/13	15D	15D	22.2	15D	15D	15D	15D	15D	15.2	
	4/14	15D	17.2	15D	15D	15D	15D	15D	15D	15D	
	4/15	15D	15D	21	15D	15D	15D	15D	18.4	15D	
	6/16	15D	16.5	15D	22.8	15D	15D	15D	15D	15D	
	5/18 & 6/18	NA	18	15D	16	15D	15D	15D	15D	15D	
Zinc	12/95	NS	NS	196	10D	139	46	227	725	90	
	3/96	66	37	85	10D	60	159	222	475	76	
	6/97	45	22	42	10D	10D	10D	96	366	45	
	6/98	58	28	204	16	10D	10D	152	445	56	
	6/99	91	35	20D	45	29	20D	67	232	133	
	6/00	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	6/01	92	54	104	20D	20D	20D	59	188	53	
	7/02	100D	100D	100D	100D	10D	463	100D	103	100D	
	6/03	140	147	65.7	8.14	65.5	5D	71.9	36.8	24.7	
	6/04	79.1	134	46.3	21.9	20D	46.8	31.6	32.9	22.1	
	6/05	98	102	144	50D	50D	50D	50D	50D	143	
	6/06	99.3	86.8	294	108	467	50D	138	50D	50D	
	6/07	161	59.6	20D	20D	102	20D	20D	20D	43.1	20D
	10/07				MW-119 resampled October 2007						1430
	6/08	55.1	54.5	53.2	50D	50D	50D	50D	50D	96.4	88.8
	6/09	83.9	81.5	50D	50D	50D	50D	50D	50D	50D	69.8
	6/10	83.1	93.3	50D	50D	50D	50D	50D	50D	108	50D
	6/11	50D	50D	50D	50D	50D	50D	50D	50D	50D	50D
	6/12	50D	50D	50D	50D	50D	195	221	232	50D	50D
	5/13	65.0	50D	50D	50D	50D	50D	89.1	50D	50D	50D
	4/14	50D	50D	50D	50D	50D	50D	70.0	50D	50D	50D
	4/15	93.6	50D	50D	50D	50D	50D	64.4	50D	50D	50D
	6/16	50D	50D	50D	50D	50D	50D	166	61.5	60.3	50D
	5/18 & 6/18	NA	50D	50D	50D	50D	50D	50D	50D	50D	50D
Antimony	6/10	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/13	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	4/15	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/16	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/18 & 6/18	NA	15D	15D	15D	15D	15D	15D	15D	15D	15D
Silver	6/10	7D	7D	7D	7D	7D	7D	7D	7D	7D	7D
	6/11	7D	7D	50D	50D	50D	50D	50D	50D	50D	50D
	6/12	7D	7D	7D	7D	7D	7D	7D	7D	7D	7D
	5/13	7D	7D	7D	7D	7D	7D	7D	7D	7D	7D
	4/14	7D	7D	7D	7D	7D	7D	7D	7D	7D	7D
	4/15	7D	7D	8.6	7D	7D	7D	7D	7D	7D	7D
	6/16	7D	7D	9.8	7D	7D	7D	7D	7D	7D	7D
	5/18 & 6/18	NA	7D	7D	7D	7D	7D	7D	7D	7D	7D

Notes:

(1) D - indicates the analyte was not detected at the indicated report detection limit (shaded value)

(2) NA - Not Analyzed, NS - Not Sampled, J - Estimated Value

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119		
Acetone	12/95	NS	NS	100D	100D	100D	100D	100D	100D	100D			
	3/96	100D	100D	100D	100D	100D	100D	100D	100D	100D			
	6/97	100D	100D	100D	100D	100D	100D	100D	100D	100D			
	6/98	20D	20D	20D	20D	20D	20D	20D	20D	20D			
	6/99	10D	10D	10D	10D	10D	10D	10D	10D	10D			
	6/00	50D	50D	50D	50D	10D	50D	50D	50D	50D	MW 119 installed 2007		
	6/01	50D	50D	50D	50D	50D	50D	50D	50D	50D			
	7/02	10D	10D	10D	10D	10D	35	10D	10D	10D			
	6/03	2D	2D	2D	2D	2D	20D	15.1	3.60	2D			
	6/04	1D	10D	10D	10D	13.0	10D	10D	15.8	15.4			
	6/05	50D	50D	50D	50D	50D	25D	25D	50D	50D			
	6/06	50D	50D	50D	50D	50D	50D	50D	50D	50D			
	6/07	5D	5D	5D	5D	5D	5D	5D	5D	5D			
	10/07					MW-119 resampled October 2007						5D	
	6/08	10D	10D	10D	10D	10D	20D	10D	10D	10D		10D	
	6/09	10D	10D	10D	10D	10D	20D	10D	10D	10D		10D	
	6/10	10D	10D	10D	10D	10D	10D	32.3	10D	10D		10D	
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D		10D	
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D		10D	
	5/13	10D	10D	10D	10D	10D	10D	10D	10D	10D		10D	
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D		10D	
	4/15	22	10D	10D	10D	10D	10D	10D	10D	10D		10D	
	6/16	10D	10D	10D	10D	10D	10D	14.1	10D	10D		10D	
	5/17	10D	10D	10D	10D	11.0	10.0	331	15.8	13.8		10D	
	5/18 & 6/18	NA	10D	10D	10D	10D	11.9	10D	10D	10D		10D	
Benzene	12/95	NS	NS	5D	5D	5D	14	5D	5D	5D			
	3/96	5D	5D	5D	5D	5D	18	5D	5D	5D			
	6/97	5D	5D	5D	5D	5D	5D	5D	5D	5D			
	6/98	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D			
	6/99	2D	2D	2D	2D	2D	2.9	2D	2D	2D			
	6/00	10D	10D	10D	10D	2D	10D	11.5	10D	10D	MW 119 installed 2007		
	6/01	2D	2D	2D	2D	2D	5	6.5	2D	2D			
	7/02	1D	1D	1D	1D	1.1	4.5	5.9	1D	1D		1D	
	6/03	1D	1D	1D	1D	1D	5D	10D	1D	1D		1D	
	6/04	5D	5D	5D	5D	5D	5D	5D	5D	5D		5D	
	6/05	1D	1D	1D	1D	1D	2.4	1.7	1D	1D		1D	
	6/06	1D	1D	1D	1D	1D	1.66	1D	1D	1D		1D	
	6/07	5D	5D	5D	14	5D	5D	5D	5D	5D		5D	
	10/07					MW-119 resampled October 2007						SD	
	6/08	1D	1D	1D	1D	1D	3.0	1D	1D	1D		11.6	
	6/09	1D	1D	1D	1D	1D	2.7	1D	1D	1D		7.5	
	6/10	1D	1D	1D	1D	1D	3.6	1D	1D	1D		2.2	
	6/11	1D	1D	1D	1D	1D	1D	1D	1D	1D		1D	
	6/12	1D	1D	1D	1D	1D	1D	1D	1D	1D		1D	
	5/13	1D	1D	1D	1D	1D	1.4	1D	1D	1D		1D	
	4/14	1D	1D	1D	1D	1D	1D	1D	1D	1D		1D	
	4/15	1D	1D	1D	1D	1D	1D	1D	1D	1D		1D	
	6/16	1D	1D	1D	1D	1D	1D	1D	1D	1D		1D	
	5/17	1D	1D	1D	1D	1D	1D	1D	1D	1D		1D	
	5/18 & 6/18	NA	1D	1D	1D	1D	1D	1D	1D	1D		1D	

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
Chloroethane	12/95	NS	NS	10D	10D	78	1800	10D	10D	10D	
	3/96	10D	10D	10D	10D	10D	1600	10D	10D	10D	
	6/97	10D	10D	10D	10D	160	310	10D	10D	10D	
	6/98	0.5D	0.5D	0.5D	0.5D	64(D)	400	0.5D	0.5D	0.5D	
	6/99	2D	2D	2D	2D	2D	230	2D	2D	2D	
	6/00	10D	10D	10D	10D	31.7	252	442	10D	10D	
	6/01	2D	2D	2D	2D	33.5	210	51.8	20D	2D	
	7/02	1D	1D	1D	1D	97	74	1D	1D	1D	
	6/03	1D	1D	1D	1D	27.5	107	6.8	1D	1D	
	6/04	5D	5D	5D	5D	28.0	502	376	5D	5D	
	6/05	1D	1D	1D	1D	3.1	249	20.2	1D	1D	
	6/06	1D	1D	1D	1D	62.9	145	1.89	1D	1D	
	6/07	5D	5D	5D	5D	5D	78.3	5D	5D	5D	
	10/07					MW-119 resampled October 2007					5D
	6/08	1D	1D	1D	1D	1D	251	1D	1D	1D	9.7
	6/09	1D	1D	1D	1D	1.5	210	1D	1D	1D	6.7
	6/10	1D	1D	1D	1D	33.7	207	7.6	1D	1D	1D
	6/11	1D	1D	1D	1D	48.1	127	11.3	1D	1D	1D
	6/12	1D	1D	1D	1D	10	147	89.7	1D	1D	1D
	5/13	1D	1D	1.8	1D	1D	244	1D	1D	1D	1D
	4/14	1D	1D	1D	1D	5.0	69.8	123	1D	1D	1D
	4/15	1D	1D	1D	1D	12.7	131	10.8	1D	1D	1D
	6/16	1D	1D	1D	1D	1D	46.2	1D	1D	1D	1D
	5/17	1D	1D	1D	1D	1D	171	1D	1D	1D	1D
	5/18 & 6/18	NA	1D	1D	1D	6.4	83.6	1D	1D	1D	1D
Chloroform	12/95	NS	NS	5D	5D	5D	5D	5D	5D	5D	
	3/96	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/97	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/98	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	
	6/99	2D	2D	2D	2D	2D	2D	2D	2D	2D	
	6/00	10D	10D	10D	10D	2D	10D	10D	10D	10D	
	6/01	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	7/02	1D	1D	1D	1D	1D	1D	1D	1D	1.4	
	6/03	1D	1D	1D	1D	10D	5D	1D	1D	1D	
	6/04	5D	5D	5D	5D	5D	5D	10D	5D	5D	
	6/05	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/06	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/07	5D	5D	5D	5D	5D	5D	5D	5D	5D	5D
	10/07					MW-119 resampled October 2007					5D
	6/08	1D	1D	1D	1D	1D	2D	1D	1D	1D	1D
	6/09	1D	1D	1D	1D	1D	2D	1D	1D	1D	1D
	6/10	1D	1D	1D	1D	1D	2D	1D	1D	1D	1D
	6/11	1D	1D	1D	1D	1D	1D	1D	1D	1D	1D
	6/12	1D	1D	1D	1D	1.0	1D	1D	1D	1D	1D
	5/13	1D	1D	1D	1D	1D	1D	1D	1D	1D	1D
	4/14	1D	1D	1D	1D	1D	1D	1D	1D	1D	1D
	4/15	1D	1D	1D	1D	1D	1D	1D	1D	1D	1D
	6/16	1D	1D	1D	1D	1D	1D	1D	1D	1D	1D
	5/17	1D	1D	1D	1D	1D	1D	1D	1D	1D	1D
	5/18 & 6/18	NA	1D	1D	1D	1D	1D	1D	1D	1D	1D



## Appendix G

## LABORATORY ANALYTICAL RESULTS - Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
1,1-Dichloroethane	12/95	NS	NS	SD	SD	160	25	36	11	SD	
	3/96	SD	SD	SD	SD	SD	30	47	9	14	
	6/97	SD	SD	SD	SD	SD	SD	SD	SD	SD	
	6/98	0.5D	0.5D	0.5D	0.5D	39	0.5D	22	11	0.5D	
	6/99	2D	2D	2D	15.6	17.8	10.5	19.7	10.1	2.2	
	6/00	10D	10D	10D	10D	14.4	2D	32.5	10D	10D	
	6/01	2D	2D	2D	2D	23.9	8.6	13.9	32.9	2D	
	7/02	1D	2.3	1D	1D	16	15	1D	56	1.2	
	6/03	1D	1D	1D	1D	12.4	10D	21.5	32.2	1.30	
	6/04	SD	SD	SD	SD	17.7	SD	31.7	79.7	SD	
	6/05	1D	1D	1D	1D	5	26.5	13.1	21.6	1.3	
	6/06	1D	1D	1D	1D	14.3	10	8.65	17.8	1D	
	6/07	SD	SD	SD	SD	15.1	7.5	23.5	SD	SD	
	10/07					MW-119 resampled October 2007					SD
	6/08	1D	1D	1D	1D	10.2	31	23.3	6.8D	1D	15.7
	6/09	1D	1D	1D	1D	25.7	2.0	6.2	14.2	1D	4.2
	6/10	1D	1D	1D	1D	9.8	2.7	4.6	12.4	1D	1D
	6/11	1D	1D	1D	1D	10.4	1.6	4.9	12.4	1D	1D
	6/12	1D	1D	1D	1D	19.1	11.8	5.1	2.2	1D	1D
	5/13	1D	1D	14.1	1D	1D	47.5	6.9	8.9	1D	1D
	4/14	1D	1D	1D	1D	15.2	1.8	7.1	20.8	1D	1D
	4/15	1D	1D	1D	1D	5.8	2.7	5.3	7.6	1D	1D
	6/16	1D	1D	1D	1D	20.4	1D	4.7	2.2	1D	1D
	5/17	1D	1D	1D	1D	9.8	1.1	9.9	4.8	1D	1D
	5/18 & 6/18	NA	1D	1D	1D	6	1D	2.2	12.3	1D	1D
1,2-Dichloroethane	12/95	NS	NS	SD	SD	SD	SD	10	SD	SD	
	3/96	SD	SD	SD	SD	SD	5	10	SD	SD	
	6/97	SD	SD	SD	SD	SD	SD	SD	SD	SD	
	6/98	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	
	6/99	2D	2D	2D	2D	2D	2D	3	2D	2D	
	6/00	10D	10D	10D	10D	2D	10D	10D	10D	10D	
	6/01	2D	2D	2D	2D	11.4	2D	2D	2.4	2D	
	7/02	1D	1D	1D	1D	5.7	1D	1D	5.9	1D	
	6/03	1D	3.59	1D	1.59	1.20	10D	SD	3.1	1D	
	6/04	SD	SD	SD	SD	SD	SD	SD	7.75	SD	
	6/05	1D	1D	1D	1D	2.6	1.3	1.5	1D		
	6/06	1D	1D	1D	1D	1.78	1D	1D	1D	1D	
	6/07	SD	SD	SD	SD	SD	SD	SD	SD	SD	
	10/07					MW-119 resampled October 2007					SD
	6/08	1D	1D	1D	1D	1D	2.8	2.2	1D	1D	1.9
	6/09	1D	1D	1D	1D	1D	2D	1D	1D	1D	1D
	6/10	1D	1D	1D	1D	1D	2D	1D	1D	1D	1D
	6/11	1D	1D	1D	1D	1D	1D	1D	1D	1D	1D
	6/12	1D	1D	1D	1D	1D	1D	1D	1D	1D	1D
	5/13	1D	1D	1D	1D	1D	3.8	1D	1D	1D	1D
	4/14	1D	1D	1D	1D	1D	1D	1D	1D	1D	1D
	4/15	1D	1D	1D	1D	1D	1D	1D	1D	1D	1D
	6/16	1D	1D	1D	1D	1D	1D	1D	1D	1D	1D
	5/17	1D	1D	1D	1D	1.4	1D	2.5	1D	1D	1D
	5/18 & 6/18	NA	1D	1D	1D	1D	1D	1D	1D	1D	1D

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
1,1-Dichloroethene	12/95	NS	NS	5D	5D	5D	5D	5D	7	5D	
	3/96	5D	5D	5D	5D	5D	5D	5D	7	5D	
	6/97	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/98	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	
	6/99	2D	2D	2D	2D	2D	2D	2D	2D	2D	
	6/00	10D	10D	10D	10D	2D	10D	10D	10D	10D	
	6/01	2D	2D	2D	2D	2D	2D	2D	2D	2D	
	7/02	1D	2.7	1D	1.1	1D	1D	1D	1.6	1D	
	6/03	1D	2	1D	1.10	1D	10D	5D	1D	1D	
	6/04	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/05	1D	1	1D	1.2	1D	1D	1D	1D	1D	
	6/06	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/07	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	10/07	MW-119 resampled October 2007									
	6/08	1D	1D	1D	1D	1D	2D	1D	1D	1D	
	6/09	1D	1D	1D	1D	1D	2D	1D	1D	1D	
	6/10	1D	1D	1D	1D	1D	2D	1D	1D	1D	
	6/11	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/12	1D	1.2	1D	1D	1D	1D	1D	1D	1D	
	5/13	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	4/14	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	4/15	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/16	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/17	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/18 & 6/18	NA	1D	1D	1D	1D	1D	1D	1D	1D	
1,2-Trans Dichloroethene	12/95	NS	NS	5D	5D	5D	5D	5D	5D	5D	
	3/96	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/97	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/98	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	
	6/99	2D	2D	2D	2D	2D	2D	2D	2D	2D	
	6/00	10D	10D	10D	10D	2D	10D	10D	10D	10D	
	6/01	2D	2D	2D	2D	2D	2D	2D	2D	2D	
	7/02	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/03	1D	1D	1D	1D	1D	10D	5D	1D	1D	
	6/04	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/05	1D	1D	1D	1D	5.6	1.1	2.9	1D	1D	
	6/06	1D	1D	1D	1D	1D	1D	2.01	1D	1D	
	6/07	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	10/07	MW-119 resampled October 2007									
	6/08	1D	1D	1D	1D	0.78D	0.53	1D	1D	1.3	
	6/09	1D	1D	1D	1D	2D	1D	1D	1D	1D	
	6/10	1D	1D	1D	1D	1D	2D	1.6	1D	1D	
	6/11	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/12	1D	1D	1D	1D	1D	1D	1.7	1D	1D	
	5/13	1D	1D	1D	1D	1D	2.2	7.0	1D	1D	
	4/14	1D	1D	1D	1D	1D	1.0	1.3	1D	1D	
	4/15	1D	1D	1D	1D	1D	1D	1.5	1D	1D	
	6/16	1D	1D	1D	1D	1D	1D	1.5	1D	1D	
	5/17	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/18 & 6/18	NA	1D	1D	1D	1D	1D	1D	1D	1D	

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
Methylene Chloride	12/95	NS	NS	5D	5D	5D	12	5D	5D	5D	
	3/96	5D	5D	5D	5D	5D	13	5D	5D	5D	
	6/97	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/98	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	
	6/99	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/00	25D	25D	25D	25D	5D	25D	25D	25D	25D	
	6/01	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	7/02	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/03	5D	5D	5D	5D	5D	50D	25D	5D	5D	
	6/04	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/05	5D	5D	5D	5D	5D	2.5D	2.5D	5D	5D	
	6/06	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/07	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	10/07	MW-119 resampled October 2007									
	6/08	1D	1D	1D	1D	1D	2D	1D	1D	1D	
	6/09	1D	1D	1D	1D	1D	3.1	1D	1D	1D	
	6/10	1D	1D	1D	1D	1D	2D	1D	1D	1D	
	6/11	1D	2.6	1D	1D	1.3	1D	1D	1D	1D	
	6/12	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/13	1D	1D	1D	1D	1D	1.6	1D	1D	1D	
	4/14	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	4/15	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/16	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/17	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/18 & 6/18	NA	1D	1D	1D	1D	1D	1D	1D	1D	
Tetrachloroethene (PCE)	12/95	NS	NS	5D	5D	5D	5D	33	5D	5D	
	3/96	5D	5D	5D	5D	5D	5D	96	5D	5D	
	6/97	5D	5D	5D	5D	5D	5D	17	5D	5D	
	6/98	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	6	0.5D	0.5D	
	6/99	2D	2D	2D	10.5	11.7	2D	12.9	2D	2D	
	6/00	10D	10D	10D	10D	2D	10D	10D	10D	10D	
	6/01	2D	2D	2D	2D	2.4	2D	2D	6.1	2D	
	7/02	1D	1D	1D	1D	2	2.6	1D	15	1D	
	6/03	1D	1D	1D	1D	5D	10D	1D	7.3	1D	
	6/04	5D	5D	5D	5D	7.14	5D	5D	12.0	5D	
	6/05	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/06	1D	1D	1D	1D	1D	1D	1D	3.49	1D	
	6/07	5D	5D	5D	5D	5D	5D	7.35	5D	5D	
	10/07	MW-119 resampled October 2007									
	6/08	1D	1D	1D	1D	1.8D	2D	2.7	1D	1D	
	6/09	1D	1D	1D	1D	7.5	2D	1.7	1D	1D	
	6/10	1D	1D	1D	1D	1D	2D	1D	1.6	1D	
	6/11	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/12	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/13	1D	1D	1D	1D	1D	1D	1D	1.1	1D	
	4/14	1D	1D	1D	1D	1D	1D	1D	2.8	1D	
	4/15	1D	1D	1D	1D	1D	1D	1D	1.2	1D	
	6/16	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/17	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/18 & 6/18	NA	1D	1D	1D	1D	1D	1D	1.7	1D	



## Appendix G

## LABORATORY ANALYTICAL RESULTS - Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
Toluene	12/95	NS	NS	5D	5D	36	5D	5D	5D	5D	
	3/96	5D	5D	5D	5D	7	5D	5D	5D	5D	
	6/97	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/98	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	
	6/99	2D	2D	2D	2D	2D	2D	2D	2D	2D	
	6/00	10D	10D	10D	10D	2D	10D	10D	10D	10D	
	6/01	2D	2D	2D	2D	2D	2D	2D	2D	2D	
	7/02	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/03	1D	1D	1D	1D	1D	10D	5D	1D	1D	
	6/04	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/05	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/06	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/07	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	10/07	MW-119 resampled October 2007									
	6/08	1D	1D	1D	1D	1D	2D	1D	1D	1D	
	6/09	1D	1D	1D	1D	1D	2D	1D	1D	1D	
	6/10	1D	1D	1D	1D	1D	2D	1D	1D	1D	
	6/11	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/12	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/13	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	4/14	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	4/15	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/16	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/17	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/18 & 6/18	NA	1D	1D	1D	1D	1D	1D	1D	1D	
1,1,1-Trichloroethane (TCA)	12/95	NS	NS	5D	5D	5D	5D	5D	5D	5D	
	3/96	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/97	5D	5D	5D	5D	5D	17	28	14	5D	
	6/98	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	
	6/99	2D	2D	2D	2D	2D	2D	2D	2.2	2D	
	6/00	10D	3.6	10D	10D	2D	10D	10D	10D	10D	
	6/01	2D	2D	2D	2D	2D	2D	2D	5.7	2D	
	7/02	1D	2	1D	1.2	1D	1D	1D	11	1.6	
	6/03	1D	1D	1D	1D	1D	10D	5D	3.2	1	
	6/04	5D	5D	5D	5D	5D	5D	5D	8.04	5D	
	6/05	1D	1.4	1D	1D	1D	1D	1D	1.8	1	
	6/06	1D	1.09	1D	1D	1D	1D	1D	1D	1D	
	6/07	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	10/07	MW-119 resampled October 2007									
	6/08	1D	1D	1D	1D	1D	2D	1D	1D	1.1	
	6/09	1D	1D	1D	1D	1.3	2D	1D	1D	1D	
	6/10	1D	1D	1D	1D	1D	2D	1D	1D	1D	
	6/11	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/12	1D	1.6	1D	1D	1D	1D	1D	1D	1D	
	5/13	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	4/14	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	4/15	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/16	1D	1D	1D	1D	1.7	1D	1D	1D	1D	
	5/17	1D	1D	1D	1D	1.2	1D	1D	1D	1D	
	5/18 & 6/18	NA	1D	1D	1D	1D	1D	1D	1D	1D	

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
1,1,2-Trichloroethane	12/95	NS	NS	5D	5D	5D	5D	13	5D	5D	
	3/96	5D	5D	5D	5D	5D	5D	11	5D	5D	
	6/97	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/98	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	0.5D	
	6/99	2D	2D	2D	2D	2D	2D	4.8	2D	2D	
	6/00	10D	10D	10D	10D	2D	10D	10D	10D	10D	
	6/01	2D	2D	2D	2D	2D	2D	11.4	2D	2D	
	7/02	1D	1D	1D	1D	1D	1D	27	1D	1D	
	6/03	1D	1D	1D	1D	1D	10D	5D	6.8	1D	
	6/04	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/05	1D	1D	1D	1D	1D	1D	1D	1.9	1D	
	6/06	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/07	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	10/07	MW-119 resampled October 2007									
	6/08	1D	1D	1D	1D	1D	2D	1D	1D	1D	
	6/09	1D	1D	1D	1D	1D	2D	1D	1D	1D	
	6/10	1D	1D	1D	1D	1D	2D	1D	1D	1D	
	6/11	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/12	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/13	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	4/14	1D	1D	1D	1D	1D	1D	1D	1.6	1D	
	4/15	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/16	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/17	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/18 & 6/18	NA	1D	1D	1D	1D	1D	1D	1D	1D	
Trichloroethene (TCE)	12/95	NS	NS	5D	5D	5D	5D	26	7	5D	
	3/96	5D	5D	5D	5D	5D	5D	110	6	5D	
	6/97	5D	5D	5D	5D	8	5D	44	6	5D	
	6/98	0.5D	0.5D	0.5D	9	6	0.5D	35	0.5D	0.5D	
	6/99	2D	2D	2D	2D	9.9	2D	71	27	2D	
	6/00	10D	10D	10D	10D	10D	2D	10D	10D	10D	
	6/01	2D	2D	2D	2D	3	2D	2D	4	2D	
	7/02	1D	1D	1D	1D	2.5	1.3	1D	6.7	1D	
	6/03	1D	1D	1D	1D	3.7	10D	5D	4.7	1D	
	6/04	5D	5D	5D	5D	5D	5D	5D	5D	5D	
	6/05	1D	1D	1D	1D	6.7	1D	10.2	2.1	1D	
	6/06	1D	1D	1D	1D	1.07	1D	2.67	2.08	1D	
	6/07	5D	5D	5D	5D	9.4	5D	5D	5D	5D	
	10/07	MW-119 resampled October 2007									
	6/08	1D	1D	1D	1D	5.3	2D	2D	1D	1D	
	6/09	1D	1D	1D	1D	5.1	2D	2.4	1.3	1D	
	6/10	1D	1D	1D	1D	1D	2D	7.2	1.1	1D	
	6/11	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/12	1D	1D	1D	1D	2.1	1D	1.1	1D	1D	
	5/13	1D	1D	1.7	1D	1D	1D	1.5	1.0	1D	
	4/14	1D	1D	1D	1D	1.2	1D	1D	1.5	1D	
	4/15	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	6/16	1D	1D	1D	1D	1D	1D	1.0	1D	1D	
	5/17	1D	1D	1D	1D	1D	1D	1D	1D	1D	
	5/18 & 6/18	NA	1D	1D	1D	1D	1D	1D	1D	1D	

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
Vinyl Chloride	12/95	NS	NS	10D	10D	10D	10D	31	10D	10D	
	3/96	10D	10D	10D	10D	10D	10D	72	10D	10D	
	6/97	10D	10D	10D	10D	10D	10D	19	10D	10D	
	6/98	0.5D	0.5D	0.5D	24.6	14	0.5D	35	0.5D	0.5D	
	6/99	2D	2D	2D	2D	2D	3.1	40.7	2D	2D	
	6/00	10D	10D	10D	10D	2D	10D	10D	10D	10D	MW 119 installed 2007
	6/01	2D	2D	2D	2D	58.6	2D	2D	2D	2D	
	7/02	1D	1D	1D	1D	1D	4.5	1D	3.8	1D	
	6/03	1D	1D	1D	1D	1D	10D	9.90	2	1D	
	6/04	5D	5D	5D	5D	5D	5D	5.8	5D	5D	
	6/05	1D	1D	1D	1D	2.9	17.2	5.8	1D	1D	
	6/06	1D	1D	1D	1D	3.47	5.44	2.42	1.11	1D	
	6/07	5D	5D	5D	5D	5D	7	5D	5D	5D	
	10/07					MW-119 resampled October 2007					5D
	6/08	1D	1D	1D	1D	1D	17.0	1D	1D	1D	58.5
	6/09	1D	1D	1D	1D	1D	2D	1.6	1D	1D	16.2
	6/10	1D	1D	1D	1D	1D	6D	1.3	1D	1D	1D
	6/11	1D	1D	1D	1D	1.4	1D	1D	1D	1D	1D
	6/12	1D	1D	1D	1D	1.1	5.8	1D	1D	1D	1D
	5/13	1D	1D	1D	1D	1D	15.5	1.5	1D	1D	1D
	4/14	1D	1D	1D	1D	1D	1D	1.6	1D	1D	1D
	4/15	1D	1D	1D	1D	1D	1D	1D	1D	1D	1D
	6/16	1D	1D	1D	1D	1D	1D	1.3	1D	1D	1D
	5/17	1D	1D	1D	1D	1D	1D	1.2	1D	1D	1D
	5/18 & 6/18	NA	1D	1D	1D	1D	1.1	1D	1D	1D	1D
Xylene (Total)	12/95	3D	3D	3D	3D	3D	3D	3D	3D	3D	3D
	6/11	3D	3D	3D	3D	3D	3D	3D	3D	3D	3D
	6/12	3D	3D	3D	3D	3D	3D	3D	3D	3D	3D
	5/13	3D	3D	3D	3D	3D	3D	3D	3D	3D	3D
	4/14	3D	3D	3D	3D	3D	3D	3D	3D	3D	3D
	4/15	3D	3D	3D	3D	3D	3D	3D	3D	3D	3D
	6/16	3D	3D	3D	3D	3D	3D	3D	3D	3D	3D
	5/17	3D	3D	3D	3D	3D	3D	3D	3D	3D	3D
	5/18 & 6/18	NA	3D	3D	3D	3D	3D	3D	3D	3D	3D

## Notes:

(1) D - indicates the analyte was not detected at the indicated report detection limit (shaded value).

(2) NA - Not Analyzed; NS - Not Sampled; F - Estimated Value

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Semi-Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
Anthracene	12/95	NS	NS	10D	10D	10D	10D	10D	10D	10D	
	3/96	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/97	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/98	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/99	10D	10D	10D	10D	260.4D	10D	10D	10D	10D	
	6/00	10D	10D	10D	10D	1000D	10D	10D	10D	10D	
	6/01	10D	10D	10D	10D	200D	10D	2020D	10D	10D	
	7/02	10.4D	10.3D	11.1	11.9D	10.9D	10.6D	38.6	10.2D	10.3D	
	6/03	10D	10D	10.2D	10D	10.3D	10.2D	10.1D	10.1D	10D	
	6/04	10D	10D	10D	10D	10D	10.2D	10.1D	10D	10D	
	6/05	9.71D	9.71D	9.71D	9.71D	9.71D	10D	10D	9.71D	9.71D	
	6/06	9.71D	9.52D	9.90D	9.52D	9.52D	47.6D	9.52	9.52D	9.90D	
	6/07	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	10/07	MW-119 resampled October 2007									
	6/08	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/09	10.2D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	5/13	11D	10D	10D	10D	10D	10.9D	10D	10D	10D	
	4/14	11D	10D	10D	10D	10D	10.9D	10D	10D	10D	
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D	
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	
Bis (2-Ethylhexyl) phthalate	3/95										
	6/97										
	6/98	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/99	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/00	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/01	10D	10D	10D	10D	20D	10D	2020D	10D	10D	
	6/02	10.4D	10.3D	11.1D	11.9D	10.9D	11.3D	10.5D	10.2D	10.3D	
	6/03	10D	10D	10.2D	10D	10.3D	10.2D	10.1D	10.1D	10D	
	6/04	10D	10D	10D	10D	10D	50D	10D	10D	10D	
	6/05	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/06	9.71D	9.52D	9.9D	9.52D	9.52D	47.6D	93.8	9.52D	9.9D	
	6/07	10D	17.4	10D	10D	10D	242	17.6	10D	10D	
	6/08	10D	10D	10D	10D	10D	535	10.1	10D	14.9	
	6/09	425	10.2D	10D	10D	23.7	79.2	20.3	10D	14.3	
	6/10	14.5	10D	10.4D	10.2D	10D	10.3D	12.7	10D	14.4	
	6/11	10D	10D	135	10D	10D	10D	10D	10D	10D	
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	5/13	11D	10D	10D	10D	10D	10.9D	10D	10D	10D	
	4/14	11D	10D	10D	10D	10D	10.9D	10D	10D	10D	
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Semi-Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	10D
Chrysene	12/95	NS	NS	10D	10D	10D	10D	10D	10D	10D	
	3/96	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/97	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/98	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/99	10D	10D	10D	10D	260.4D	10D	10D	10D	10D	
	6/00	10D	10D	10D	10D	1000D	10D	10D	10D	10D	
	6/01	10D	10D	10D	10D	200D	10D	2020D	10D	10D	
	7/02	10.4D	10.3D	11.1D	11.9D	10.9D	10.6D	10.3D	10.2D	10.3D	
	6/03	10D	10D	10.2D	10D	10.3D	10.2D	10.1D	10.1D	10D	
	6/04	10D	10D	10D	10D	50D	10D	10D	10D	10D	
	6/05	9.71D	9.71D	9.71D	9.71D	9.71D	15	10D	9.71D	9.71D	
	6/06	9.71D	9.52D	9.90D	9.52D	9.52D	47.6D	9.52D	9.52D	9.90D	
	6/07	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	10/07										
	6/08	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/09	10.2D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	5/13	11D	10D	10D	10D	10D	10.5D	10D	10D	10D	
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	
	6/16	9.1D	9.4D	9.4D	5.5D	9.5D	9.5D	9.6D	9.6D	9.6D	
	5/17	9.3D	9.8D	9.3D	5.3D	9.3D	10.6	9.3D	9.3D	9.8D	
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	
Fluorene	12/95	NS	NS	10D	10D	10D	10D	10D	10D	10D	
	3/96	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/97	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/98	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/99	10D	10D	10D	10D	260.4D	10D	10D	10D	10D	
	6/00	10D	10D	10D	10D	1000D	10D	10D	10D	10D	
	6/01	10D	10D	10D	10D	200D	10D	2020D	10D	10D	
	7/02	10.4D	10.3D	11.1	11.9D	10.9D	10.6D	15	10.2D	10.3D	
	6/03	10D	10D	10.2D	10D	10.3D	10.2D	10.1D	10.1D	10D	
	6/04	10D	10D	10D	10D	50D	10D	10D	10D	10D	
	6/05	9.71D	9.71D	9.71D	9.71D	9.71D	12	10D	9.71D	9.71D	
	6/06	9.71D	9.52D	9.90D	9.52D	9.52D	47.6D	9.52D	9.52D	9.90D	
	6/07	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	10/07										
	6/08	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/09	10.2D	10D	10D	10D	10D	10D	10D	10D	10D	

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Semi-Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	10D
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/13	11D	10D	10D	10D	10D	10.5D	10D	10D	10D	10D
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	10D
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	10D
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2-Methyl-Naphthalene	12/95	NS	NS	10D	10D	10D	10D	10D	10D	10D	
	3/96	25D	25D	25D	25D	25D	25D	25D	25D	25D	
	6/97	10D	10D	10D	10D	10D	18	10D	10D	10D	
	6/98	10D	10D	10D	10D	10D	110	10D	10D	10D	
	6/99	10D	10D	10D	10D	260.4D	520.8	10D	10D	10D	
	6/00	10D	10D	10D	10D	1000D	10D	10D	10D	10D	
	6/01	10D	10D	10D	10D	10D	200D	10D	2020D	10D	
	7/02	10.4D	10.3D	11.1D	11.9D	10.9D	10.6D	10.5D	10.2D	10.3D	
	6/03	10D	10D	10.2D	10D	10.3D	11.9	10.1D	10.1D	10D	
	6/04	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/05	9.71D	9.71D	9.71D	9.71D	9.71D	70	10D	9.71D	9.71D	
	6/06	9.71D	9.52D	9.90D	9.52D	9.52D	47.6D	9.52D	9.52D	9.90D	
	6/07	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	10/07	MW-119 resampled October 2007									10D
	6/08	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/09	10.2D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	5/13	11D	10D	10D	10D	10D	10.5D	10D	10D	10D	
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	4/15	10D	10D	10D	11.8D	11.8D	11.4	10D	10D	10D	
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	12.8	9.3D	9.3D	9.8D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	21.2	9.1D	9.3D	9.1D	10D
<hr/>											
Naphthalene	12/95	NS	NS	10D	10D	10D	10D	10D	10D	10D	
	3/96	25D	25D	25D	25D	25D	25D	25D	25D	25D	
	6/97	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/98	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/99	10D	10D	10D	10D	260.4D	10D	10D	10D	10D	
	6/00	10D	10D	10D	10D	10D	1000D	10D	10D	10D	
	6/01	10D	10D	10D	10D	10D	200D	10D	2020D	10D	
	7/02	10.4	10.3D	11.1	11.9	10.9	10.6D	11.7	10.2	10.3	
	6/03	10D	10D	10.2D	10D	10.3D	10.2D	10.1D	10.1D	10D	
	6/04	10D	10D	10D	10D	10D	10D	10D	10D	10D	

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Semi-Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
	6/05	9.71D	9.71D	9.71D	9.71D	9.71D	10D	10D	9.71D	9.71D	
	6/06	9.71D	9.52D	9.90D	9.52D	9.52D	47.6D	9.52D	9.52D	9.90D	
	6/07	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	10/07				MW-119 resampled October 2007						10D
	6/08	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/09	10.2D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	5/13	11D	10D	10D	10D	10D	10.9D	10D	10D	10D	
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	
	6/16	9.1D	9.4D	9.4D	5.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	5.3D	9.3D	9.3D	9.3D	9.3D	9.8D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	10D
Phenanthrene	12/95	NS	NS	10D	10D	10D	10D	10D	10D	10D	
	3/96	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/97	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/98	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/99	10D	10D	10D	10D	266.4D	10D	10D	10D	10D	
	6/00	10D	10D	10D	10D	1000D	10D	10D	10D	10D	
	6/01	10D	10D	10D	10D	200D	10D	2020D	10D	10D	
	7/02	10.4	10.3D	11.1	11.9	10.9	10.6D	38.5	10.2	10.3	
	6/03	10D	10D	10.2D	10D	10.3D	10.2D	10.1D	10.1D	10D	
	6/04	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/05	9.71D	9.71D	9.71D	9.71D	9.71D	45	10D	9.71D	9.71D	
	6/06	9.71D	9.52D	9.90D	9.52D	9.52D	47.6D	9.52	9.52D	9.90D	
	6/07	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	10/07				MW-119 resampled October 2007						10D
	6/08	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/09	10.2D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	5/13	11D	10D	10D	10D	10D	10.9D	10D	10D	10D	
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	
	6/16	9.1D	9.4D	9.4D	5.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	5.3D	9.3D	16.1	9.3D	9.3D	9.8D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	27	9.1D	9.3D	9.1D	10D
Benzo(a)anthracene	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	10D
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/13	11D	10D	10D	10D	10D	10.9D	10D	10D	10D	10D

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Semi-Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	10D
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	10D
Benzo(a)pyrene	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	10D
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/13	11D	10D	10D	10D	10D	10.5D	10D	10D	10D	10D
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	10D
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	10D
Benzo(b)fluoranthene	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	10D
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/13	11D	10D	10D	10D	10D	10.5D	10D	10D	10D	10D
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	10D
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	10D
Benzo(k)fluoranthene	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	10D
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/13	11D	10D	10D	10D	10D	10.5D	10D	10D	10D	10D
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	10D
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	10D
Benzoic Acid	6/10	50D	50D	52.1D	51D	50D	51.5D	50D	50D	50D	50D
	6/11	50D	50D	50D	50D	50D	50D	50D	50D	50D	50D
	6/12	50D	50D	50D	50D	50D	50D	50D	50D	50D	50D
	5/13	54.9D	50D	50D	50D	50D	54.3D	50D	50D	50D	50D
	4/14	50D	50D	50D	50D	50D	50D	50D	50D	50D	50D
	4/15	50D	50D	50D	58.8D	58.8D	50D	50D	50D	50D	50D
	6/16	45.5D	47.2D	47.2D	47.6D	47.6D	47.6D	48.1D	48.1D	48.1D	49.0D
	5/17	46.3D	49.0D	46.3D	46.3D	46.3D	46.3D	46.3D	49.0D	49.0D	49.0D
	5/18 & 6/18	NA	45.5D	46.3D	45.5D	45.5D	45.5D	45.5D	46.3D	45.5D	50D



## Appendix G

## LABORATORY ANALYTICAL RESULTS - Semi-Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
P-Chloro-m-cresol (3,4 Methylphenol)	6/10	20D	20D	20.8D	20.4D	20D	20.6D	20D	20D	20D	20D
	6/11	20D	20D	20D	20D	20D	20D	20D	20D	20D	20D
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/13	11D	10D	10D	10D	10D	10.5D	10D	10D	10D	10D
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	10D
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.3D	9.3D	9.1D	9.1D
Dibenzofuran	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	10D
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/13	11D	10D	10D	10D	10D	10.5D	10D	10D	10D	10D
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	10D
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	10D
2,4-Dimethyl-phenol	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	10D
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/13	11D	10D	10D	10D	10D	10.5D	10D	10D	10D	10D
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	10D
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	10D
Dimethyl-phthalate	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	10D
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/13	11D	10D	10D	10D	10D	10.5D	10D	10D	10D	10D
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	10D
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	10D
Di-n-butyl-phthalate	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	10D
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/13	11D	10D	10D	10D	10D	10.5D	10D	10D	10D	10D
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	10D

## Appendix G

## LABORATORY ANALYTICAL RESULTS - Semi-Volatile Organics (ug/L)

Sand Springs Petrochemical Complex  
Tulsa County  
Sand Springs, Oklahoma

Analyte	Dates	MW 14	MW 15	MW 101	MW 102	MW 103	MW 104	MW 105	MW 106	MW 107	MW 119
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	10D
<b>4,6-Dinitro-o-cresol (4,6-Dinitro-2-methylphenol )</b>	6/10	50D	50D	52.1D	51D	50D	51.5D	50D	50D	50D	50D
	6/11	50D	50D	50D	50D	50D	50D	50D	50D	50D	50D
	6/12	50D	50D	50D	50D	50D	50D	50D	50D	50D	50D
	5/13	54.9D	50D	50D	50D	50D	54.3D	50D	50D	50D	50D
	4/14	50D	50D	50D	50D	50D	50D	50D	50D	50D	50D
	4/15	50D	50D	50D	58.8D	58.8D	50D	50D	50D	50D	50D
	6/16	45.5D	47.2D	47.2D	47.6D	47.6D	47.6D	48.1D	48.1D	48.1D	49.0D
	5/17	46.3D	49.0D	46.3D	46.3D	46.3D	46.3D	46.3D	46.3D	49.0D	49.0D
	5/18 & 6/18	NA	45.5D	46.3D	45.5D	45.5D	45.5D	45.5D	46.3D	45.5D	50D
<b>Phenol</b>	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	10D
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/13	11D	10D	10D	10D	10D	10.9D	10D	10D	10D	10D
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	10D
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	10D
<b>Pyrene</b>	6/10	10D	10D	10.4D	10.2D	10D	10.3D	10D	10D	10D	10D
	6/11	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	6/12	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	5/13	11D	10D	10D	10D	10D	10.9D	10D	10D	10D	10D
	4/14	10D	10D	10D	10D	10D	10D	10D	10D	10D	10D
	4/15	10D	10D	10D	11.8D	11.8D	10D	10D	10D	10D	10D
	6/16	9.1D	9.4D	9.4D	9.5D	9.5D	9.5D	9.6D	9.6D	9.6D	9.8D
	5/17	9.3D	9.8D	9.3D	9.3D	9.3D	9.3D	9.3D	9.3D	9.8D	9.8D
	5/18 & 6/18	NA	9.1D	9.3D	9.1D	9.1D	9.1D	9.1D	9.3D	9.1D	10D

## Notes:

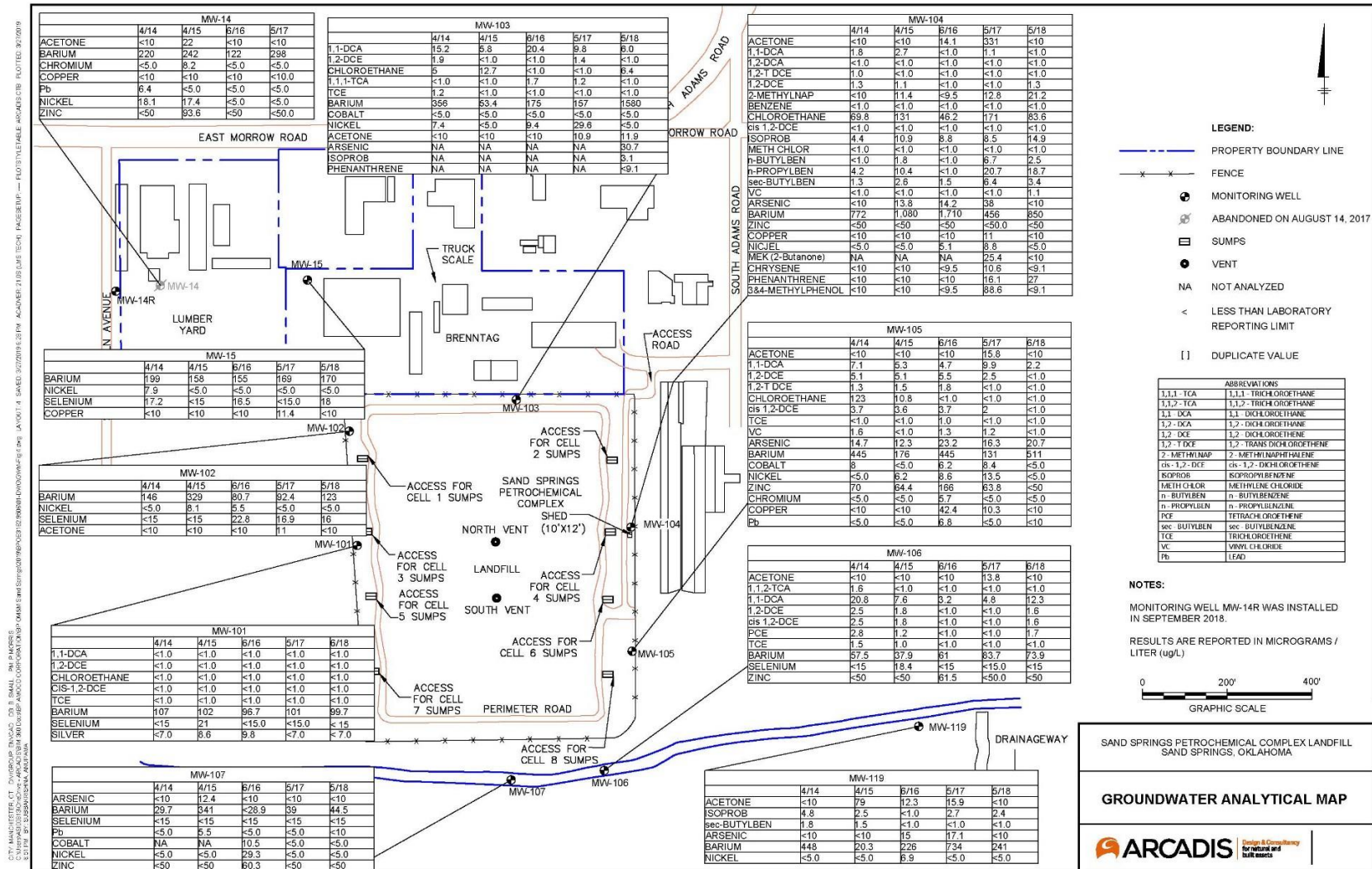
(1) D - indicates the analyte was not detected at the indicated report detection limit (shaded value).

(2) NA - Not Analyzed, NS- Not Sampled, J - Estimated Value

Fifth Five-Year Review  
Sand Springs Petrochemical Complex

## APPENDIX H

### Groundwater Monitoring Results Map



## APPENDIX I

### Mann Kendall Statistical Trends

**Appendix I**  
**Summary Statistics and Trend Results<sup>1,2,3</sup>**  
**Sand Springs Petrochemical Complex Landfill**  
**Sand Springs, Oklahoma**

Well ID	Analyte	Date Range	Figure	FOD	Detected Results Summary				Mann-Kendall Test			Sen's Estimator of Slope	
					Range	Mean	Median	SD	Result	P-Value	S Value	Result	Slope (Units/Day)
MW 14	Barium	03/96 - 06/16	F-1	21 / 21	122 - 696	348	263	181	DWN	0.013	-75	DWN	-0.0273
	Chromium	03/96 - 06/16	F-2	17 / 21	8.2 - 42	15.9	10.9	10.8	DWN	0.017	-71	DWN	-0.000955
MW 15	TCA	03/96 - 06/16	F-3	5 / 21	1.1 - 3.6	1.9	1.6	0.99	NST	0.271	-16	NT	0
MW 101	Barium	12/95 - 06/16	F-4	20 / 22	96.7 - 1550	249	130	343	DWN	0.002	-105	DWN	-0.0124
	Beryllium	12/95 - 06/16	F-5	4 / 21	1.3 - 23.7	7.7	2.945	10.7	NST	0.345	-10	NT	0
	Selenium	12/95 - 06/16	F-6	8 / 22	6.3 - 22.2	14.9	14.95	6.1	UP	0.022	62	NT	0
MW 103	Barium	12/95 - 06/16	F-7	22 / 22	53.4 - 12000	1090	465.5	2500	DWN	0.006	-91	DWN	-0.0725
	Chromium	12/95 - 06/16	F-8	9 / 22	8 - 88.4	26.4	18	25.1	DWN	0.013	-71	NT	0
	1,2-Dichloroethane	12/95 - 06/16	F-9	4 / 22	1.2 - 11.4	5	3.74	4.7	NST	0.166	-24	NT	0
	Chloroethane	12/95 - 06/16	F-10	16 / 22	1.5 - 160	44.8	32.6	42.7	DWN	0.041	-62	NT	-0.00585
	PCE	12/95 - 06/16	F-11	5 / 22	2 - 11.7	6.1	7.14	4	NST	0.177	-25	NT	0
	TCE	12/95 - 06/16	F-12	13 / 22	1.1 - 9.8	4.8	5.1	3	NST	0.080	-49	NT	-0.000171
	Vinyl Chloride	12/95 - 06/16	F-13	8 / 22	1.1 - 58.8	13.6	3.185	22.8	NST	0.359	-11	NT	0
MW 104	Benzene	12/95 - 06/16	F-14	11 / 22	1.4 - 18	5.4	3	5.4	DWN	0.032	-62	NT	-0.000102
	Chloroethane	12/95 - 06/16	F-15	21 / 22	5 - 1600	247	207	326	DWN	0.048	-80	NST	-0.0230
MW 105	Chromium	12/95 - 06/16	F-16	6 / 22	5.7 - 78	34.8	18.45	32.5	DWN	0.018	-58	NT	0
	Nickel	12/95 - 06/16	F-17	15 / 21	5.1 - 51	21.9	17.5	16.1	DWN	0.025	-65	NT	-0.00335
	Zinc	12/95 - 06/16	F-18	14 / 21	31.6 - 227	120	92.55	67.5	NST	0.098	-43	NT	-0.00298
	1,1-Dichloroethane	12/95 - 06/16	F-19	20 / 22	4.6 - 47	18.9	13.5	12.6	DWN	0.005	-92	DWN	-0.00298
	1,2-Dichloroethane	12/95 - 06/16	F-20	5 / 22	1.3 - 10	5.3	3	4.3	DWN	0.017	-56	NT	0
	Benzene	12/95 - 06/16	F-21	4 / 22	1.7 - 11.5	6.4	6.2	4	NST	0.082	-34	NT	0
	PCE	12/95 - 06/16	F-22	7 / 22	2.7 - 96	25	12.9	32.9	DWN	<0.001	-92	NT	0
	TCE	12/95 - 06/16	F-23	12 / 22	1 - 110	26	8.7	34.4	DWN	0.023	-68	NT	-0.000681
	Vinyl Chloride	12/95 - 06/16	F-24	15 / 22	1.3 - 72	15.7	5.8	20.5	DWN	0.002	-99	DWN	-0.00202
MW 106	Zinc	12/95 - 06/16	F-25	11 / 21	32.8 - 725	263	232	219	DWN	<0.001	-116	DWN	-0.0352
	1,1,2-Trichloroethane	12/95 - 06/16	F-26	5 / 22	1.6 - 27	9.7	8.8	10.5	NST	0.321	-13	NT	0
	1,2-Dichloroethane	12/95 - 06/16	F-27	5 / 22	1.5 - 7.8	4.1	3.1	2.6	NST	0.177	-25	NT	0
	PCE	12/95 - 06/16	F-28	10 / 22	1.1 - 15	5.2	3.145	4.9	NST	0.332	15	NT	0
	TCA	12/95 - 06/16	F-29	7 / 22	1.8 - 14	6.6	5.7	4.7	DWN	0.018	-62	NT	0
	TCE	12/95 - 06/16	F-30	13 / 22	1 - 27	5.4	4	8.9	DWN	0.002	-100	NT	-0.000593
MW 107	Beryllium	12/95 - 06/16	F-31	8 / 21	1.5 - 9.7	4.6	4	2.5	NST	0.458	-4	NT	0
	Nickel	12/95 - 06/16	F-32	12 / 21	8.6 - 98	51.9	53.5	27.5	DWN	0.002	-90	NT	-0.00560
	1,1-Dichloroethane	12/95 - 06/16	F-33	5 / 22	1.2 - 14	4	1.3	5.6	DWN	0.029	-50	NT	0
	TCA	12/95 - 06/16	F-34	4 / 22	1 - 1.8	1.2	1.05	0.29	NST	0.368	-9	NT	0

**Abbreviations:**

= insufficient data for calculating statistics (n < 4)  
FOD = frequency of detection (# detects / # samples)  
mean = arithmetic mean  
SD = standard deviation

NST = no significant trend  
NT = no trend  
DWN = downward trend  
UP = upward trend

H<sub>0</sub> = null hypothesis: no significant trend (slope = 0)  
H<sub>a</sub> = alternative hypothesis: significant trend (slope ≠ 0)  
95% CI = 95% confidence interval

**Notes:**

- All analytical results are in µg/L. Result values less than 10 are reported to 2 significant figures; values greater than 10 are reported to 3 significant figures. P-values are reported to 3 decimal places.
- Trend results are presented when at least four samples and one detected value are available.
- Non-detects were assigned a common value less than the minimum detected value (95% of the minimum detected value) (EPA, 2009).

**Reference:**

USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance.

**Fifth Five-Year Review**  
**Sand Springs Petrochemical Complex**

## APPENDIX J

### Site Inspection Checklist



## Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Sand Springs Petrochemical Complex Superfund Site	Date of inspection:
Location and Region: Sand Springs, OK Region 6	EPA ID: OKD980748446
Agency, office, or company leading the five-year review: OK Department of Environmental Quality	Weather/temperature:
<b>Remedy Includes:</b> (Check all that apply) <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <input checked="" type="checkbox"/> Landfill cover/containment  <input checked="" type="checkbox"/> Access controls  <input checked="" type="checkbox"/> Institutional controls  <input type="checkbox"/> Groundwater pump and treatment  <input type="checkbox"/> Surface water collection and treatment  <input checked="" type="checkbox"/> Other: <u>Landfill leachate collection, treatment, and disposal.</u>  <u>Annual groundwater monitoring and sampling</u> </div> <div style="width: 45%;"> <input type="checkbox"/> Monitored natural attenuation  <input type="checkbox"/> Groundwater containment  <input type="checkbox"/> Vertical barrier walls           </div> </div>	
<b>Attachments:</b> <input type="checkbox"/> Inspection team roster attached <input type="checkbox"/> Site map attached	
II. INTERVIEWS (Check all that apply)	
1. O&M site manager <u>Jason Luckett</u> <u>Project Manager</u> <div style="display: flex; justify-content: space-between; margin: 0;"> <span>Name</span> <span>Title</span> <span>Date</span> </div> Interviewed <input type="checkbox"/> at site <input type="checkbox"/> at office <input type="checkbox"/> by phone    Phone no. _____ Problems, suggestions; <input type="checkbox"/> Report attached _____ _____	
2. O&M staff <u>Tyler Stewart</u> <u>Sr. O&amp;M Tech.</u> <div style="display: flex; justify-content: space-between; margin: 0;"> <span>Name</span> <span>Title</span> <span>Date</span> </div> Interviewed <input type="checkbox"/> at site <input type="checkbox"/> at office <input type="checkbox"/> by phone    Phone no. _____ Problems, suggestions; <input type="checkbox"/> Report attached _____ _____	



3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency \_\_\_\_\_  
Contact \_\_\_\_\_  
Name \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_ Phone no. \_\_\_\_\_  
Problems; suggestions; ☐ Report attached \_\_\_\_\_

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Agency \_\_\_\_\_  
Contact \_\_\_\_\_  
Name \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_ Phone no. \_\_\_\_\_  
Problems; suggestions; ☐ Report attached \_\_\_\_\_

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Agency \_\_\_\_\_  
Contact \_\_\_\_\_  
Name \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_ Phone no. \_\_\_\_\_  
Problems; suggestions; ☐ Report attached \_\_\_\_\_

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Agency \_\_\_\_\_  
Contact \_\_\_\_\_  
Name \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_ Phone no. \_\_\_\_\_  
Problems; suggestions; ☐ Report attached \_\_\_\_\_

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4. **Other interviews (optional)** ☐ Report attached.


III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)			
1.	<b>O&amp;M Documents</b> <input checked="" type="checkbox"/> O&M manual <input type="checkbox"/> As-built drawings <input type="checkbox"/> Maintenance logs Remarks _____	<input checked="" type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> N/A <input type="checkbox"/> N/A <input type="checkbox"/> N/A
2.	<b>Site-Specific Health and Safety Plan</b> <input checked="" type="checkbox"/> Contingency plan/emergency response plan Remarks _____	<input checked="" type="checkbox"/> Readily available <input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> N/A <input type="checkbox"/> N/A
3.	<b>O&amp;M and OSHA Training Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A
4.	<b>Permits and Service Agreements</b> <input type="checkbox"/> Air discharge permit <input type="checkbox"/> Effluent discharge <input checked="" type="checkbox"/> Waste disposal, POTW <input type="checkbox"/> Other permits Remarks <u>Permit No. 2496 - expires 12/31/21</u>	<input type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input checked="" type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> N/A <input type="checkbox"/> N/A <input type="checkbox"/> N/A <input type="checkbox"/> N/A
5.	<b>Gas Generation Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A
6.	<b>Settlement Monument Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A
7.	<b>Groundwater Monitoring Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date <input type="checkbox"/> N/A
8.	<b>Leachate Extraction Records</b> Remarks _____	<input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> N/A
9.	<b>Discharge Compliance Records</b> <input type="checkbox"/> Air <input checked="" type="checkbox"/> Water (effluent) Remarks _____	<input type="checkbox"/> Readily available <input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> N/A <input type="checkbox"/> N/A
10.	<b>Daily Access/Security Logs</b> Remarks <u>Site perimeter fence is maintained to provide security and label.</u>	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> N/A

IV. O&M COSTS																																											
1.	<b>O&amp;M Organization</b> <input type="checkbox"/> State in-house <input type="checkbox"/> PRP in-house <input type="checkbox"/> Federal Facility in-house <input type="checkbox"/> Other _____	<input type="checkbox"/> Contractor for State <input checked="" type="checkbox"/> Contractor for PRP <input type="checkbox"/> Contractor for Federal Facility																																									
2.	<b>O&amp;M Cost Records</b> <input type="checkbox"/> Readily available <input type="checkbox"/> Up to date <input type="checkbox"/> Funding mechanism/agreement in place Original O&M cost estimate _____ <input type="checkbox"/> Breakdown attached  <div style="text-align: center;">Total annual cost by year for review period if available</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">From _____</td> <td style="width: 15%;">To <u>2016</u></td> <td style="width: 20%; text-align: right;"><u>\$44,601</u></td> <td style="width: 50%;"><input type="checkbox"/> Breakdown attached</td> </tr> <tr> <td></td> <td style="text-align: center;">Date      Date</td> <td style="text-align: center;">Total cost</td> <td></td> </tr> <tr> <td>From _____</td> <td>To <u>2017</u></td> <td style="text-align: right;"><u>\$47,000</u></td> <td><input type="checkbox"/> Breakdown attached</td> </tr> <tr> <td></td> <td style="text-align: center;">Date      Date</td> <td style="text-align: center;">Total cost</td> <td></td> </tr> <tr> <td>From _____</td> <td>To <u>2018</u></td> <td style="text-align: right;"><u>\$96,000</u></td> <td><input type="checkbox"/> Breakdown attached</td> </tr> <tr> <td></td> <td style="text-align: center;">Date      Date</td> <td style="text-align: center;">Total cost</td> <td></td> </tr> <tr> <td>From _____</td> <td>To <u>2019</u></td> <td style="text-align: right;"><u>\$34,050</u></td> <td><input type="checkbox"/> Breakdown attached</td> </tr> <tr> <td></td> <td style="text-align: center;">Date      Date</td> <td style="text-align: center;">Total cost</td> <td></td> </tr> <tr> <td>From _____</td> <td>To _____</td> <td style="text-align: center;">Total cost</td> <td><input type="checkbox"/> Breakdown attached</td> </tr> <tr> <td></td> <td style="text-align: center;">Date      Date</td> <td style="text-align: center;">Total cost</td> <td></td> </tr> </table>			From _____	To <u>2016</u>	<u>\$44,601</u>	<input type="checkbox"/> Breakdown attached		Date      Date	Total cost		From _____	To <u>2017</u>	<u>\$47,000</u>	<input type="checkbox"/> Breakdown attached		Date      Date	Total cost		From _____	To <u>2018</u>	<u>\$96,000</u>	<input type="checkbox"/> Breakdown attached		Date      Date	Total cost		From _____	To <u>2019</u>	<u>\$34,050</u>	<input type="checkbox"/> Breakdown attached		Date      Date	Total cost		From _____	To _____	Total cost	<input type="checkbox"/> Breakdown attached		Date      Date	Total cost	
From _____	To <u>2016</u>	<u>\$44,601</u>	<input type="checkbox"/> Breakdown attached																																								
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From _____	To <u>2017</u>	<u>\$47,000</u>	<input type="checkbox"/> Breakdown attached																																								
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From _____	To <u>2018</u>	<u>\$96,000</u>	<input type="checkbox"/> Breakdown attached																																								
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From _____	To <u>2019</u>	<u>\$34,050</u>	<input type="checkbox"/> Breakdown attached																																								
	Date      Date	Total cost																																									
From _____	To _____	Total cost	<input type="checkbox"/> Breakdown attached																																								
	Date      Date	Total cost																																									
3.	<b>Unanticipated or Unusually High O&amp;M Costs During Review Period</b> Describe costs and reasons: <u>Costs associated with 2018 included leachate pump rental for collection and detection pumps due to poor recovery and inoperable pumps/equipment. A new mobile leachate trailer was purchased for enhanced recovery and collection.</u>																																										
V. ACCESS AND INSTITUTIONAL CONTROLS <input type="checkbox"/> Applicable <input type="checkbox"/> N/A																																											
<b>A. Fencing</b>																																											
1.	<b>Fencing damaged</b> <input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Gates secured <input type="checkbox"/> N/A Remarks <u>Sections of fence were replaced along north west side adjacent to Brenntag.</u>																																										
<b>B. Other Access Restrictions</b>																																											
1.	<b>Signs and other security measures</b> <input type="checkbox"/> Location shown on site map <input type="checkbox"/> N/A Remarks <u>Site is fenced and locked.</u>																																										

<b>C. Institutional Controls (ICs)</b>			
1.	<b>Implementation and enforcement</b>		
	Site conditions imply ICs not properly implemented	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
	Site conditions imply ICs not being fully enforced	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
	Type of monitoring (e.g., self-reporting, drive by) _____		
	Frequency _____		
	Responsible party/agency _____		
	Contact _____		
	Name	Title	Date Phone no.
	Reporting is up-to-date <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
	Reports are verified by the lead agency <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
	Specific requirements in deed or decision documents have been met <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
	Violations have been reported <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
	Other problems or suggestions: <input type="checkbox"/> Report attached		
	_____		
	_____		
	_____		
2.	<b>Adequacy</b>	<input checked="" type="checkbox"/> ICs are adequate	<input type="checkbox"/> ICs are inadequate <input type="checkbox"/> N/A
	Remarks	_____	
	_____		
<b>D. General</b>			
1.	<b>Vandalism/trespassing</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No vandalism evident
	Remarks	<i>Site entrance gate was cut in June 2018 due to vandalism associated with trespassing to Tulare Convention. Fence was repaired in 2018</i>	
2.	<b>Land use changes on site</b>	<input checked="" type="checkbox"/> N/A	
	Remarks	_____	
3.	<b>Land use changes off site</b>	<input type="checkbox"/> N/A	
	Remarks	_____	
<b>VI. GENERAL SITE CONDITIONS</b>			
<b>A. Roads</b>	<input checked="" type="checkbox"/> Applicable	<input type="checkbox"/> N/A	
1.	<b>Roads damaged</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Roads adequate <input type="checkbox"/> N/A
	Remarks	_____	

<b>B. Other Site Conditions</b>			
Remarks _____ _____ _____ _____ _____			
<b>VII. LANDFILL COVERS</b> <input checked="" type="checkbox"/> Applicable <input type="checkbox"/> N/A			
<b>A. Landfill Surface</b>			
1.	<b>Settlement (Low spots)</b> Areal extent _____ Depth _____ Remarks _____	<input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Settlement not evident	
2.	<b>Cracks</b> Lengths _____ Widths _____ Depths _____ Remarks _____	<input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Cracking not evident	
3.	<b>Erosion</b> Areal extent _____ Depth _____ Remarks _____	<input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Erosion not evident	
4.	<b>Holes</b> Areal extent _____ Depth _____ Remarks _____	<input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Holes not evident	
5.	<b>Vegetative Cover</b> <input checked="" type="checkbox"/> Grass <input checked="" type="checkbox"/> Cover properly established <input checked="" type="checkbox"/> No signs of stress <input type="checkbox"/> Trees/Shrubs (indicate size and locations on a diagram) Remarks _____		
6.	<b>Alternative Cover (armored rock, concrete, etc.)</b> <input checked="" type="checkbox"/> N/A Remarks _____		
7.	<b>Bulges</b> Areal extent _____ Height _____ Remarks _____	<input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Bulges not evident	
8.	<b>Wet Areas/Water Damage</b> <input checked="" type="checkbox"/> Wet areas/water damage not evident <input type="checkbox"/> Wet areas <input type="checkbox"/> Location shown on site map   Areal extent _____ <input type="checkbox"/> Ponding <input type="checkbox"/> Location shown on site map   Areal extent _____ <input type="checkbox"/> Seeps <input type="checkbox"/> Location shown on site map   Areal extent _____ <input type="checkbox"/> Soft subgrade <input type="checkbox"/> Location shown on site map   Areal extent _____ Remarks _____		

9.	<b>Slope Instability</b>	<input type="checkbox"/> Slides	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> No evidence of slope instability
	Areal extent _____			
	Remarks _____			
<b>B. Benches</b>				
	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A		
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)				
1.	<b>Flows Bypass Bench</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A or okay	
	Remarks _____			
2.	<b>Bench Breached</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A or okay	
	Remarks _____			
3.	<b>Bench Overtopped</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A or okay	
	Remarks _____			
<b>C. Letdown Channels</b>				
	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A		
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)				
1.	<b>Settlement</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of settlement	
	Areal extent _____	Depth _____		
	Remarks _____			
2.	<b>Material Degradation</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of degradation	
	Material type _____	Areal extent _____		
	Remarks _____			
3.	<b>Erosion</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of erosion	
	Areal extent _____	Depth _____		
	Remarks _____			



4.	<b>Undercutting</b> <input type="checkbox"/> Location shown on site map <input type="checkbox"/> No evidence of undercutting Areal extent _____ Depth _____ Remarks _____
5.	<b>Obstructions</b> Type _____ <input type="checkbox"/> No obstructions <input type="checkbox"/> Location shown on site map      Areal extent _____ Size _____ Remarks _____
6.	<b>Excessive Vegetative Growth</b> Type _____ <input type="checkbox"/> No evidence of excessive growth <input type="checkbox"/> Vegetation in channels does not obstruct flow <input type="checkbox"/> Location shown on site map      Areal extent _____ Remarks _____
<b>D. Cover Penetrations</b> <input checked="" type="checkbox"/> Applicable <input type="checkbox"/> N/A	
1.	<b>Gas Vents</b> <input type="checkbox"/> Active <input checked="" type="checkbox"/> Passive <input type="checkbox"/> Properly secured/locked <input checked="" type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input checked="" type="checkbox"/> Good condition <input type="checkbox"/> Evidence of leakage at penetration <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A Remarks _____
2.	<b>Gas Monitoring Probes</b> <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> Evidence of leakage at penetration <input type="checkbox"/> Needs Maintenance <input checked="" type="checkbox"/> N/A Remarks _____
3.	<b>Monitoring Wells (within surface area of landfill)</b> <input type="checkbox"/> Properly secured/locked <input checked="" type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> Evidence of leakage at penetration <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A Remarks _____
4.	<b>Leachate Extraction Wells</b> <input type="checkbox"/> Properly secured/locked <input checked="" type="checkbox"/> Functioning <input checked="" type="checkbox"/> Routinely sampled <input checked="" type="checkbox"/> Good condition <input type="checkbox"/> Evidence of leakage at penetration <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A Remarks _____
5.	<b>Settlement Monuments</b> <input checked="" type="checkbox"/> Located <input checked="" type="checkbox"/> Routinely surveyed <input type="checkbox"/> N/A Remarks _____

<b>E. Gas Collection and Treatment</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A		
1.	<b>Gas Treatment Facilities</b> <input type="checkbox"/> Flaring <input type="checkbox"/> Thermal destruction <input type="checkbox"/> Collection for reuse <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance Remarks _____	
2.	<b>Gas Collection Wells, Manifolds and Piping</b> <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance Remarks _____	
3.	<b>Gas Monitoring Facilities</b> (e.g., gas monitoring of adjacent homes or buildings) <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A Remarks _____	
<b>F. Cover Drainage Layer</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A		
1.	<b>Outlet Pipes Inspected</b> <input type="checkbox"/> Functioning <input type="checkbox"/> N/A Remarks _____	
2.	<b>Outlet Rock Inspected</b> <input type="checkbox"/> Functioning <input type="checkbox"/> N/A Remarks _____	
<b>G. Detention/Sedimentation Ponds</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A		
1.	<b>Siltation</b> Areal extent _____ Depth _____ <input type="checkbox"/> N/A <input type="checkbox"/> Siltation not evident Remarks _____	
2.	<b>Erosion</b> Areal extent _____ Depth _____ <input type="checkbox"/> Erosion not evident Remarks _____	
3.	<b>Outlet Works</b> <input type="checkbox"/> Functioning <input type="checkbox"/> N/A Remarks _____	
4.	<b>Dam</b> <input type="checkbox"/> Functioning <input type="checkbox"/> N/A Remarks _____	



<b>H. Retaining Walls</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	<b>Deformations</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Deformation not evident
	Horizontal displacement _____	Vertical displacement _____	
	Rotational displacement _____		
	Remarks _____		
2.	<b>Degradation</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Degradation not evident
	Remarks _____		
<b>I. Perimeter Ditches/Off-Site Discharge</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	<b>Siltation</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Siltation not evident
	Areal extent _____	Depth _____	
	Remarks _____		
2.	<b>Vegetative Growth</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A
	<input type="checkbox"/> Vegetation does not impede flow		
	Areal extent _____	Type _____	
	Remarks _____		
3.	<b>Erosion</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Erosion not evident
	Areal extent _____	Depth _____	
	Remarks _____		
4.	<b>Discharge Structure</b>	<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A
	Remarks _____		
<b>VIII. VERTICAL BARRIER WALLS</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	<b>Settlement</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Settlement not evident
	Areal extent _____	Depth _____	
	Remarks _____		
2.	<b>Performance Monitoring</b>	Type of monitoring _____	
	<input type="checkbox"/> Performance not monitored		
	Frequency _____	<input type="checkbox"/> Evidence of breaching	
	Head differential _____		
	Remarks _____		

<b>IX. GROUNDWATER/SURFACE WATER REMEDIES</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
<b>A. Groundwater Extraction Wells, Pumps, and Pipelines</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	<b>Pumps, Wellhead Plumbing, and Electrical</b> <input type="checkbox"/> Good condition <input type="checkbox"/> All required wells properly operating <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A Remarks _____ _____		
2.	<b>Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b> <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance Remarks _____ _____		
3.	<b>Spare Parts and Equipment</b> <input type="checkbox"/> Readily available <input type="checkbox"/> Good condition <input type="checkbox"/> Requires upgrade <input type="checkbox"/> Needs to be provided Remarks _____ _____		
<b>B. Surface Water Collection Structures, Pumps, and Pipelines</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	<b>Collection Structures, Pumps, and Electrical</b> <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance Remarks _____ _____		
2.	<b>Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances</b> <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance Remarks _____ _____		
3.	<b>Spare Parts and Equipment</b> <input type="checkbox"/> Readily available <input type="checkbox"/> Good condition <input type="checkbox"/> Requires upgrade <input type="checkbox"/> Needs to be provided Remarks _____ _____		

<b>C. Treatment System</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	<b>Treatment Train</b> (Check components that apply) <input type="checkbox"/> Metals removal <input type="checkbox"/> Oil/water separation <input type="checkbox"/> Bioremediation <input type="checkbox"/> Air stripping <input type="checkbox"/> Carbon adsorbers <input type="checkbox"/> Filters <input type="checkbox"/> Additive (e.g., chelation agent, flocculent) <input type="checkbox"/> Others <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> Sampling ports properly marked and functional <input type="checkbox"/> Sampling/maintenance log displayed and up to date <input type="checkbox"/> Equipment properly identified <input type="checkbox"/> Quantity of groundwater treated annually <input type="checkbox"/> Quantity of surface water treated annually Remarks		
2.	<b>Electrical Enclosures and Panels</b> (properly rated and functional) <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance Remarks		
3.	<b>Tanks, Vaults, Storage Vessels</b> <input type="checkbox"/> N/A <input checked="" type="checkbox"/> Good condition <input type="checkbox"/> Proper secondary containment <input type="checkbox"/> Needs Maintenance Remarks		
4.	<b>Discharge Structure and Appurtenances</b> <input type="checkbox"/> N/A <input checked="" type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance Remarks		
5.	<b>Treatment Building(s)</b> <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Good condition (esp. roof and doorways) <input type="checkbox"/> Needs repair <input type="checkbox"/> Chemicals and equipment properly stored Remarks		
6.	<b>Monitoring Wells</b> (pump and treatment remedy) <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> All required wells located <input type="checkbox"/> Needs Maintenance <input checked="" type="checkbox"/> N/A Remarks		
<b>D. Monitoring Data</b>			
1.	Monitoring Data <input checked="" type="checkbox"/> Is routinely submitted on time <input type="checkbox"/> Is of acceptable quality		
2.	Monitoring data suggests: <input type="checkbox"/> Groundwater plume is effectively contained <input type="checkbox"/> Contaminant concentrations are declining		

<b>D. Monitored Natural Attenuation</b>			
1.	<b>Monitoring Wells</b> (natural attenuation remedy) <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> All required wells located <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A Remarks _____		
<b>X. OTHER REMEDIES</b>			
If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.			
<b>XI. OVERALL OBSERVATIONS</b>			
<b>A. Implementation of the Remedy</b>			
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). <i>The landfill, leachate collection, and monitoring wells have been operating as designed.</i>			
<b>B. Adequacy of O&amp;M</b>			
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. <i>Site and landfill inspections along with leachate collection and annual groundwater monitoring support effective remedies during the designed maintenance period for closure.</i>			

<b>C. Early Indicators of Potential Remedy Problems</b>
<p>Describe issues and observations such as unexpected changes in the cost or scope of O&amp;M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
<b>D. Opportunities for Optimization</b>
<p>Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>

## APPENDIX K

### Site Inspection Photo Log





Image of warning sign





Image of landfill slope facing north





Image of landfill cover facing southeast



Image of landfill cover facing northwest





Image of landfill slope facing south





Image of landfill collection and detection cells





Image of landfill groundwater monitoring well





Image of Solar Sipper





Image of Arkansas River facing east





Image of drums staged against the Brenntag and SSPC fence line



## APPENDIX L

### Notice to the Public Regarding the Fifth Five-Year Review

# Oklahoma Weekly Group

Owasso Reporter • Sand Springs Leader  
Skiatook Journal  
Wagoner County American-Tribune

OKLAHOMA WEEKLY GROUP  
P.O. BOX 1770  
TULSA, OK 74102-1770

Account Number

1087328

Date

August 14, 2019

OKLAHOMA DEQ  
Attn: ZAC POOL  
P.O. BOX 1677  
OKLAHOMA CITY, OK 73101

Date	Category	Description	Ad Size	Total Cost
08/14/2019	Legal Notices	EPA ID# OKD980748446 / FIVE YEAR REVIEW	2 x 63.00 CL	80.64

## Affidavit of Publication

I, Melissa Marshall, of lawful age, being duly sworn, am a legal representative of the Sand Springs Leader of Sand Springs, Oklahoma, a weekly newspaper of general circulation in Tulsa County, Oklahoma, a legal newspaper qualified to publish legal notices, as defined in 25 O.S. § 106 as amended, and thereafter, and complies with all other requirements of the laws of Oklahoma with reference to legal publication. That said notice, a true copy of which is attached hereto, was published in the regular edition of said newspaper during the period and time of publication and not in a supplement, on the DATE(S) LISTED BELOW

08/14/2019

Newspaper reference: 0000582018

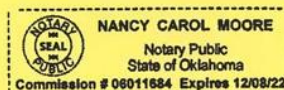
M. Marshall  
Legal Representative

Sworn to and subscribed before me this date:

AUG 15 2019

Nancy Carol Moore  
Notary Public

My Commission expires: DEC 08 2022



582018  
Published in the Sand Springs Leader, Sand Springs, Tulsa County, Oklahoma, August 14, 2019.

The Oklahoma Department of Environmental Quality (DEQ) and the US Environmental Protection Agency (EPA) are conducting a Five-Year Review of the Sand Springs Petrochemical Complex (SSPC) Superfund Site (EPA ID# OKD980748446) in Sand Springs, Oklahoma. The purpose of this review is to determine whether the site remedy is functioning as designed, whether or not maintenance is required, and whether the remedy remains protective of human health and the environment. A report documenting the Five-Year Review will be available to the public in July 2020. This will be the fifth Five-Year Review for the SSPC.

The site is located in an industrial complex on the northern bank of the Arkansas River, immediately west of Tulsa, Oklahoma. The site is comprised of approximately 235 acres and was the former location of a refinery and solvent recycling facility. Site operations resulted in contamination of soil and groundwater beneath the site. A Record of Decision, which included a remedy for contaminated soil, was published on September 29, 1987. The remedy for contaminated soil included excavation and off-site thermal destruction of sludges from a portion of the site, solidification and/or stabilization of all remaining sludges and containment of the resulting matrix in a hazardous waste cell (landfill) constructed on-site, and repair or restoration of the landfill to ensure no migration from the unit or destruction or treatment of all or a portion of its contents. A second Record of Decision, which focused on a remedy for contaminated groundwater, was published on June 28, 1988. The selected remedy for contaminated groundwater at the site included placing appropriate warning signs, restricting access, and collection and analyzing groundwater samples for a period of at least 30 years.

Current and previous Five-Year Review reports are available at <https://www.deq.ok.gov>. More information about the site is also available at <https://cumulis.epa.gov/supercpad/CurSites/cs1info.cfm?id=0601357&msspp=me>. DEQ will be conducting interviews as part of the Five-Year Review for the SSPC. If you wish to be interviewed, have any questions, or need further information concerning the SSPC, please contact:

Kelsey Bufford  
Oklahoma Department of Environmental Quality  
Land Protection Division  
707 North Robinson, P.O. Box 1677  
Oklahoma City, OK 73101  
Work: (405) 722-5184  
Email: [kelsey.bufford@deq.ok.gov](mailto:kelsey.bufford@deq.ok.gov)

Michael Hebert  
EPA Region 6  
Remedial Project Manager  
Work: (214) 665-8315  
Fax: (214) 665-6660  
Email: [hebert.michael@epa.gov](mailto:hebert.michael@epa.gov)

## APPENDIX M

### Deed Notices



## **DEED NOTICE AND LAND USE RESTRICTIONS**

### **COMPLETION OF REMEDIATION SAND SPRINGS PETROCHEMICAL COMPLEX SUPERFUND SITE OKD980748446**

**AFFECTED PROPERTY:** The Affected Property is located within the Sand Springs Petrochemical Complex Superfund Site (National Superfund Database Identification Number OKD980748446) (the "Site"), located in Tulsa County. The complete legal description of the Affected Property is attached hereto as Exhibit A.

**LEGAL BASIS FOR NOTICE:** The Oklahoma Department of Environmental Quality ("DEQ") hereby files this NOTICE OF REMEDIATION OR RELATED ACTION TAKEN PURSUANT TO THE FEDERAL COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT (hereinafter "Notice") pursuant to Oklahoma Statutes, 27A O.S. § 2-7-123 (B). This notice does not grant any right to any person not already allowed by law. This notice shall not be construed to authorize or encourage any person or other legal entity to cause or increase pollution, to avoid compliance with State or Federal laws and regulations regarding pollution or to in any manner escape responsibility for maintaining environmentally sound operations.

DEQ may take administrative or civil action to recover costs or to compel compliance with the Land Use Restrictions (described below). The Land Use Restrictions shall apply to the Affected Property and to persons who own and/or use the Affected Property until such time as the DEQ files a subsequent Notice that modifies or removes some or all of the Land Use Restrictions. Activities that cause or could cause damage to the Remedy (defined and described below) or recontamination of soil or groundwater at the Affected Property are prohibited.

**REASON FOR NOTICE:** There is contamination in the ground water and subsurface soil (at depths greater than five (5) feet beneath the Affected Property). The contaminants of concern are lead, zinc, barium, copper, and several organic chemicals such as benzene, toluene, and chlorinated hydrocarbons. Excavation and handling of subsurface soil and drilling of water wells could result in undesirable exposures to the contaminants left on the Affected Property.

**REMEDY:** The remedial actions have been completed. The remedial actions selected by the United States Environmental Protection Agency ("EPA"), as set forth in two Records of Decision ("RODs"), have been completed and the Site has been deleted from the National Priority List ("NPL") of Superfund sites (see also Federal Register, vol. 64, No. 147, dated August 2, 1999, and Vol. 65, No. 53, dated March 17, 2000).

**ENGINEERING CONTROLS:** The following engineering controls shall be used at the Affected Property to maintain the integrity of the Remedy:

- (1) Install a sub-slab ventilation/depressurization system as part of proposed building construction.
- (2) Follow the requirements of 29 Code of Federal Regulations (C.F.R.) § 1910.120 concerning HAZWOPER training requirements for construction workers who may be working with potentially contaminated subsurface soils.

**LAND USE RESTRICTIONS:**

- (1) Prohibition Against Residential Use. Commercial/Industrial Use Only. No residential, daily care, preK-12 schools, or edible agriculture uses of the Affected Property.
- (2) Building construction activities at the Affected Property shall require establishment and compliance with the following protocols:
  - a. Develop a worker safety and health program consistent with 29 C.F.R. § 1910.120.
  - b. Develop field screening procedures in order to determine if the soil is contaminated. The primary contaminants of concern are lead, zinc, barium, copper, and several organic chemicals such as benzene, toluene, and chlorinated hydrocarbons.
  - c. If contaminated soil is encountered, containerize the contaminated soil, determine whether the soil is hazardous under the Resource Conservation and Recovery Act (RCRA), and dispose of the contaminated soil according to State and Federal law.
  - d. If sulfuric acid sludge is encountered, notify the EPA, the DEQ, and Atlantic Richfield Company ("ARCO") immediately so that ARCO can perform removal activities in accordance with ARCO's approved Operation, Maintenance, and Monitoring Plan.

**CHANGES TO THE LAND USE RESTRICTIONS:** Changes to land use restrictions must be approved by DEQ or its successor agency. The person requesting the change in land use must demonstrate to DEQ's satisfaction that contamination at the site has reached levels appropriate for the proposed new land uses and that further remediation is not necessary and that additional institutional or engineering controls are adequate to achieve levels protective of human health and the environment for the proposed uses.

DEQ may require oversight costs, work plans, sampling, reports, and public participation as part of its review of the new information to support the requested change in land use restrictions. The person requesting the change will be required to follow agency procedures effective at the time of the request.


DEQ at its discretion may determine, based on the new information submitted, that contaminants are present at the Site at levels that will not pose a risk to human health or the environment if the new land use restrictions being requested are allowed. Upon making this determination, DEQ will file a recordable notice of remediation pursuant to state law in the land

records in the office of the county clerk where the Site is located designating the new land use restrictions.

This Notice and the Land Use Restrictions contained herein run with the land and no change of ownership of the Affected Property will change the Land Use Restrictions described herein above. This Notice and the Land Use Restrictions contained herein are effective upon the date of signature by the Executive Director of the DEQ.

[SIGNATURE PAGE FOLLOWS]

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

By: 


Name: Scott Thompson  
Executive Director

Date: 5/7/2014

STATE OF OKLAHOMA )  
 ) ss.  
COUNTY OF OKLAHOMA )

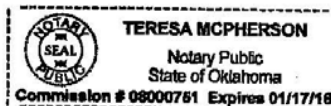
Before me, the undersigned, a Notary Public in and for such County and State, on this 7<sup>th</sup> day of May, 2014, personally appeared Scott Thompson to me known to be the identical person who subscribed the name of the maker thereof to the foregoing Notice as the Executive Director of the Oklahoma Department of Environmental Quality, and acknowledged to me that s/he executed the same as her/his free and voluntary act and deed and as of such entity, for the uses and purposes therein set forth.

Given under my hand and seal of office the day and year last above written.

  
Notary Public

My Commission Expires:

January 17, 2016



**EXHIBIT A**

**LEGAL DESCRIPTION OF THE AFFECTED PROPERTY**

[SEE ATTACHED DESCRIPTION (3 TRACTS)]



EXHIBIT A

TRACT A:

A tract of land being part of the West Four Hundred Seventy (470) feet of the Northwest Quarter (NW/4) of Section Thirteen (13), Township Nineteen (19) North, Range Eleven (11) East of the Indian Base and Meridian, Tulsa County, State of Oklahoma, according to the United States Government Survey thereof, being more particularly described as follows, to-wit:

(Continued)

Commencing at the Northwest corner of said Section 13; thence South  $00^{\circ}44'03''$  East along the West line of said Section 13 a distance of 586.54 feet; thence North  $90^{\circ}00'00''$  East a distance of 136.06 feet to the Point of Beginning; thence continuing North  $90^{\circ}00'00''$  East a distance of 333.94 feet; thence South  $00^{\circ}44'03''$  East a distance of 785.32 feet; thence South  $85^{\circ}03'09''$  West a distance of 348.98 feet; thence North  $00^{\circ}15'31''$  East a distance of 815.36 feet to the Point of Beginning.

TRACT C:

A tract of land in the Northwest Quarter (NW/4) of Section Thirteen (13), Township Nineteen (19) North, Range Eleven (11) East of the Indian Base and Meridian, Tulsa County, State of Oklahoma, according to the United States Government Survey thereof, being more particularly described as follows, to-wit:

Commencing at the Northeast corner of said NW/4; thence West along the North line of said NW/4 a distance of 726.0 feet; thence South a distance of 500.0 feet to the Point of Beginning; thence West 400.0 feet; thence South 819.42 feet to the original meander line of the left bank of the Arkansas River; thence Easterly along said meander line to a point which is 726.0 feet Westerly of the Northeast corner of said NW/4; thence North 762.67 feet to the Point of Beginning.

LEGAL DESCRIPTION:

A tract of land being out of the Northwest Quarter (NW/4) of Section Thirteen (13), Township Nineteen (19) North, Range Eleven (11) East, of the Indian Base and Meridian, Tulsa County, State of Oklahoma, and being more particularly described by metes and bounds as follows:

Commencing at a point located at the Northeast Corner of the Northwest Quarter (NW/4) of said Section Thirteen (13), thence along the North line of said Section Thirteen (13) and of the Northwest Quarter (NW/4) thereof, West 726 feet to the point of beginning of the herein described tract of land; thence South 500 feet to a point; thence West 400 feet to a point; thence South 541 feet, more or less, to the meander line of the North bank of the Arkansas River; thence in a westerly direction along said meander line of the North bank of the Arkansas River a certain distance to a point on said North bank of the Arkansas River, which point is located a distance of 470 feet East of the West line of said Section Thirteen (13) and of the Northwest Quarter (NW/4) thereof; thence in a line parallel to the West line of said Section Thirteen (13) and of the Northwest Quarter (NW/4) thereof, North a certain distance to a point in the North line of said Section Thirteen (13) and of the Northwest Quarter (NW/4) thereof, which point is located a distance of 470 feet East of the Northwest corner of said Section Thirteen (13) and of the Northwest Quarter (NW/4) thereof; thence along the North line of said Section Thirteen (13), East a distance to the POINT OF BEGINNING, according to the U.S. Government Survey thereof.



## CITY OF SAND SPRINGS

100 E. Broadway St. • P.O. Box 338 • Sand Springs, Oklahoma 74063  
Phone: 918.246.2500 • [sandspringsok.org](http://sandspringsok.org)

December 16, 2014

Amber Edwards  
Environmental Programs Specialist  
Land Protection Division  
Oklahoma Department of Environmental Quality  
707 N Robinson  
Oklahoma City OK 73102

**RE:** Zoning Designation for Sand Springs Petrochemical Complex Superfund Site

Ms. Edwards:

Per your request, this office has reviewed any zoning activities related to the Sand Springs Petrochemical Complex site referenced in your report. For this purpose, I reviewed zoning activities in Sections 13 and 14 of Township 19 North, Range 11 East. I also reviewed Sections 11 and 12 of Township 19 North, Range 11 East, as they are adjacent to the petrochemical complex site.

There have been zoning designation or classification changes in Sections 12, 13 or 14 during the reporting period. There were two zoning designation or classification changes in Section 11 during the reporting period. However, they were in the SW quarter of the section and not adjacent to the complex area boundary.

As your report indicates, the zoning designation/classification remains industrial and the applicable conditions and/or restrictions have not changed during the reporting period.

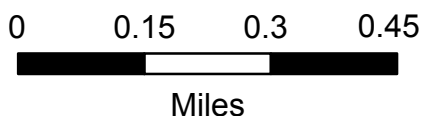
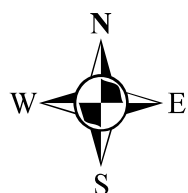
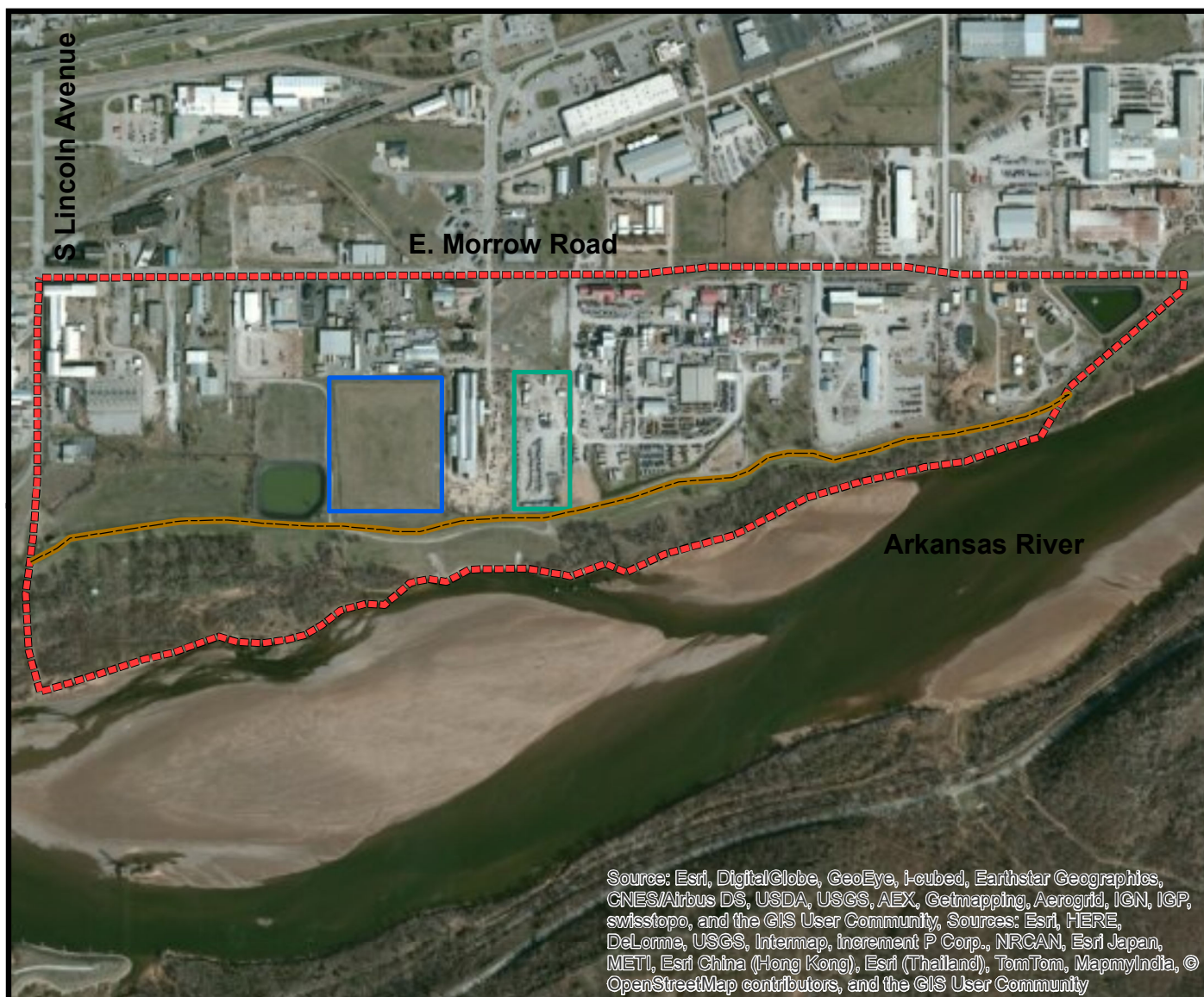
Respectfully,

Andrew W. Templeton  
Code Enforcement Supervisor  
[awtempleton@sandspringsok.org](mailto:awtempleton@sandspringsok.org)

cc: Cody Blair, Asst. City Engineer

## Figures

# Figure 1: Sand Springs Petrochemical Complex Site Map



## Legend

- - - - - Approximate Historic Site Boundary
- Landfill
- Former Glenn Wynn Site
- - - - - Levee

Fifth Five-Year Review  
Sand Springs Petrochemical Complex

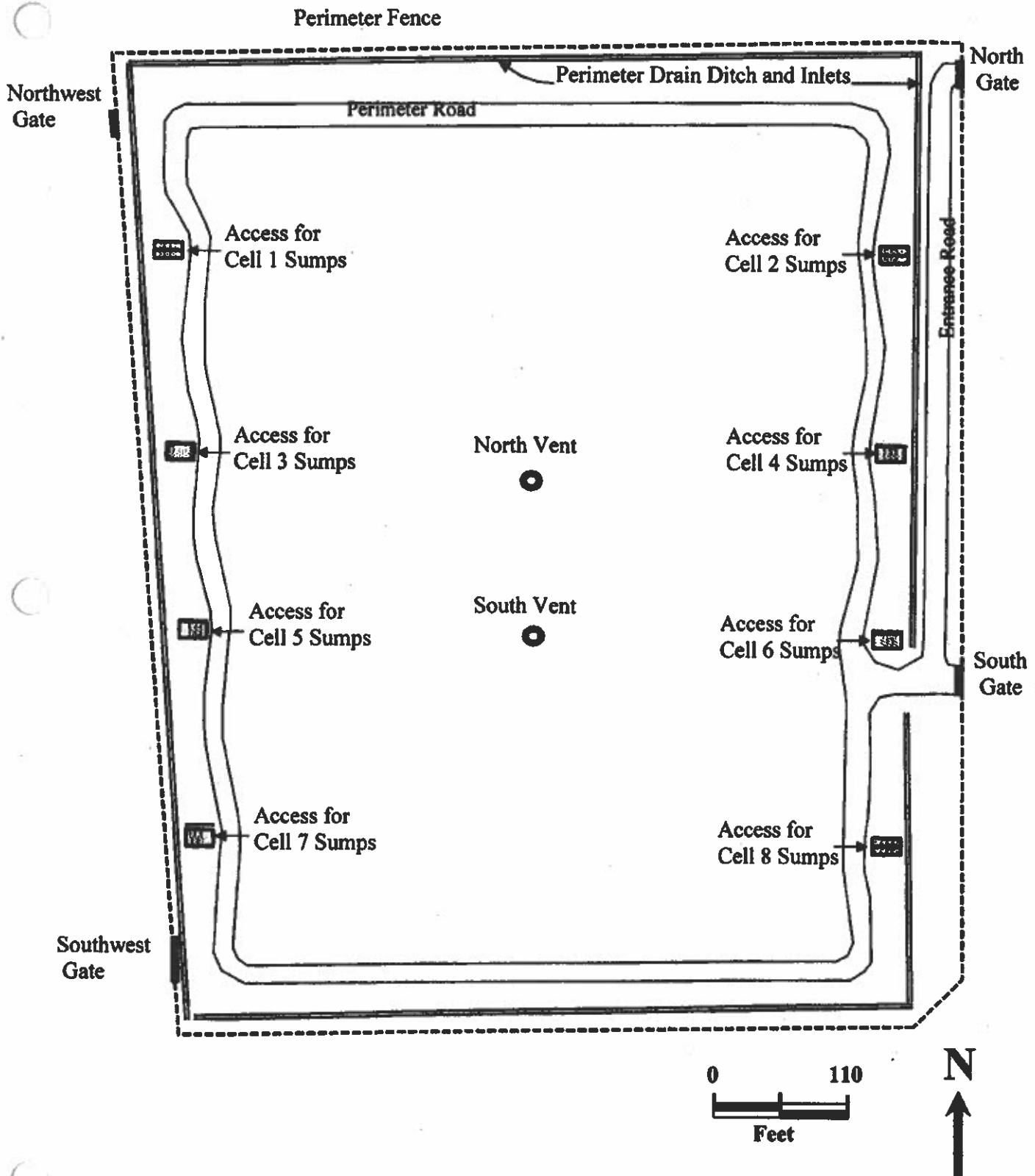


Map created by Amber Edwards  
on 11/26/2014.

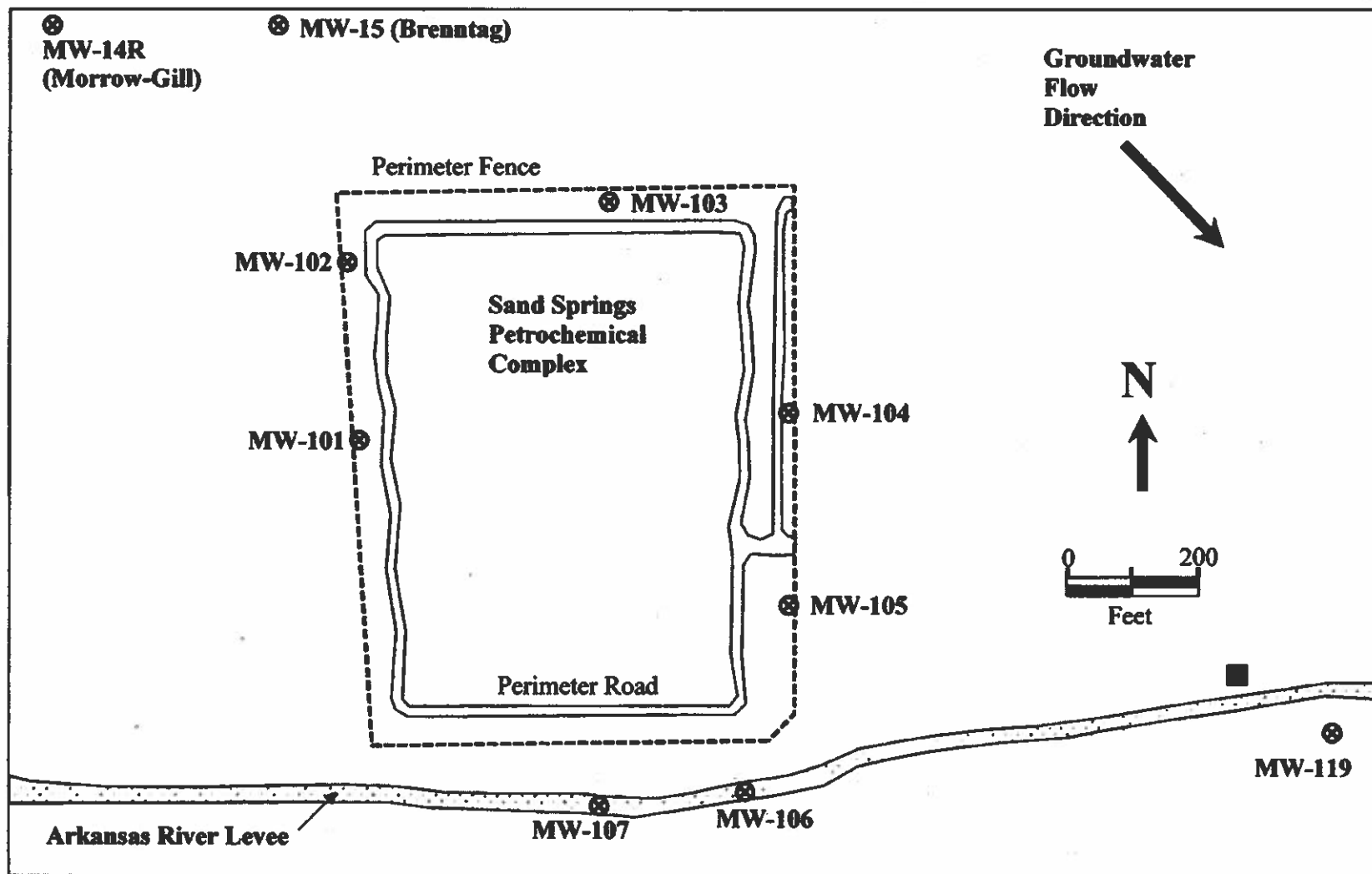
Map modified by Kelsey Bufford  
on 1/24/2020.

We make every effort to provide and maintain accurate, complete, usable, and timely information. However, some data and information on this map may be preliminary or out of date and is provided with the understanding that it is not guaranteed to be correct or complete. Conclusions drawn from, or actions undertaken on the basis of, such data and information are the sole responsibility of the user.

**Figure 2: Sand Springs Petrochemical Complex Landfill**



**Figure 3: Sand Springs Petrochemical Complex Groundwater Monitoring Well Network**



Fifth Five-Year Review  
Sand Springs Petrochemical Complex